

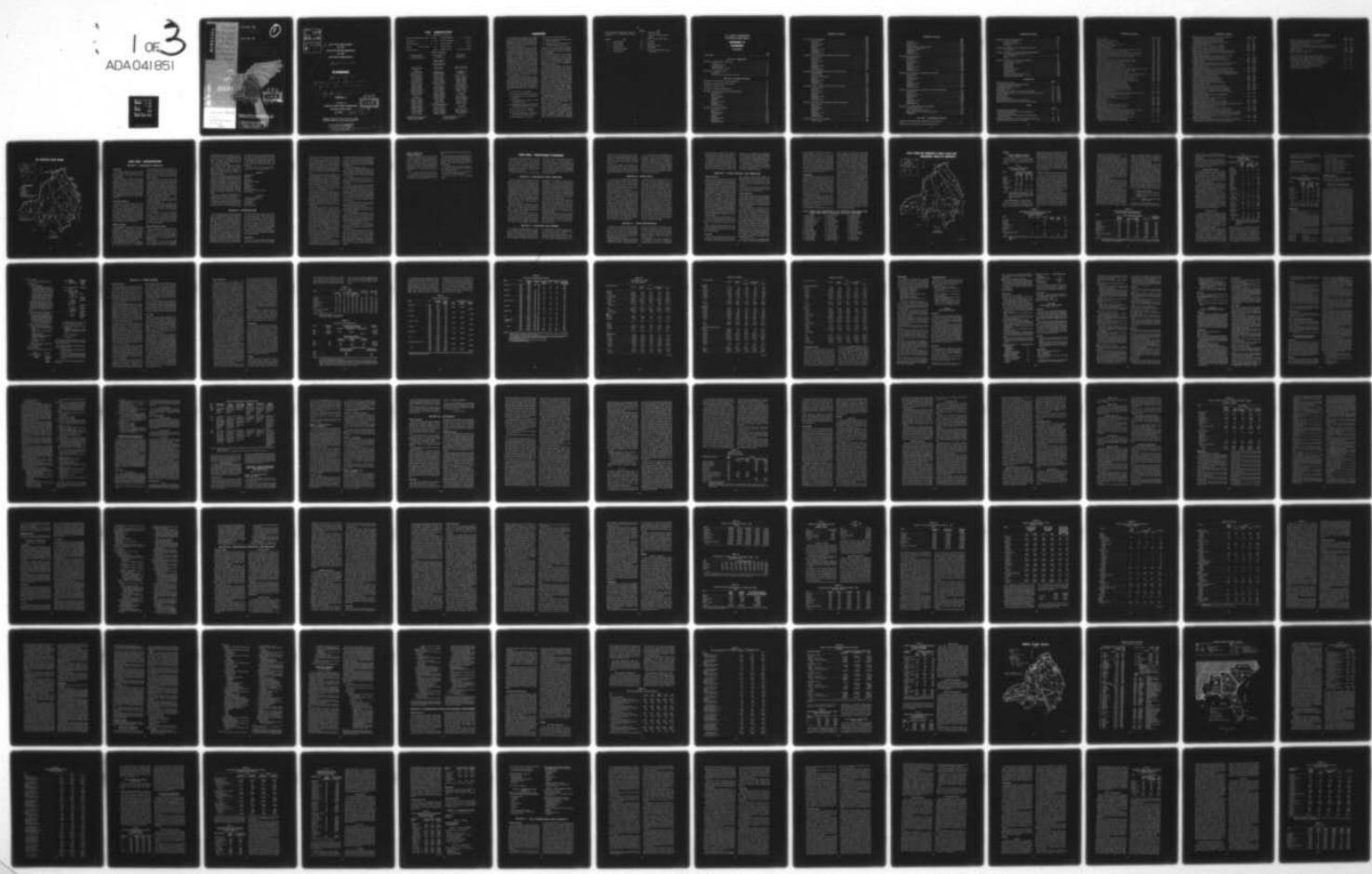
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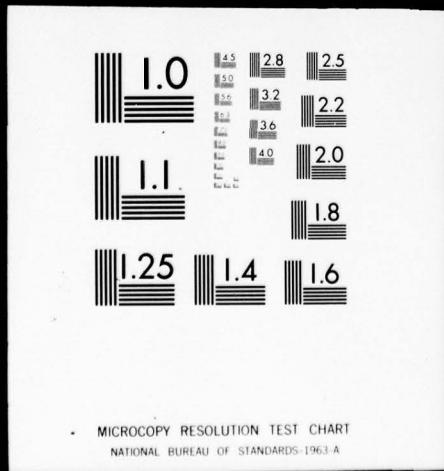
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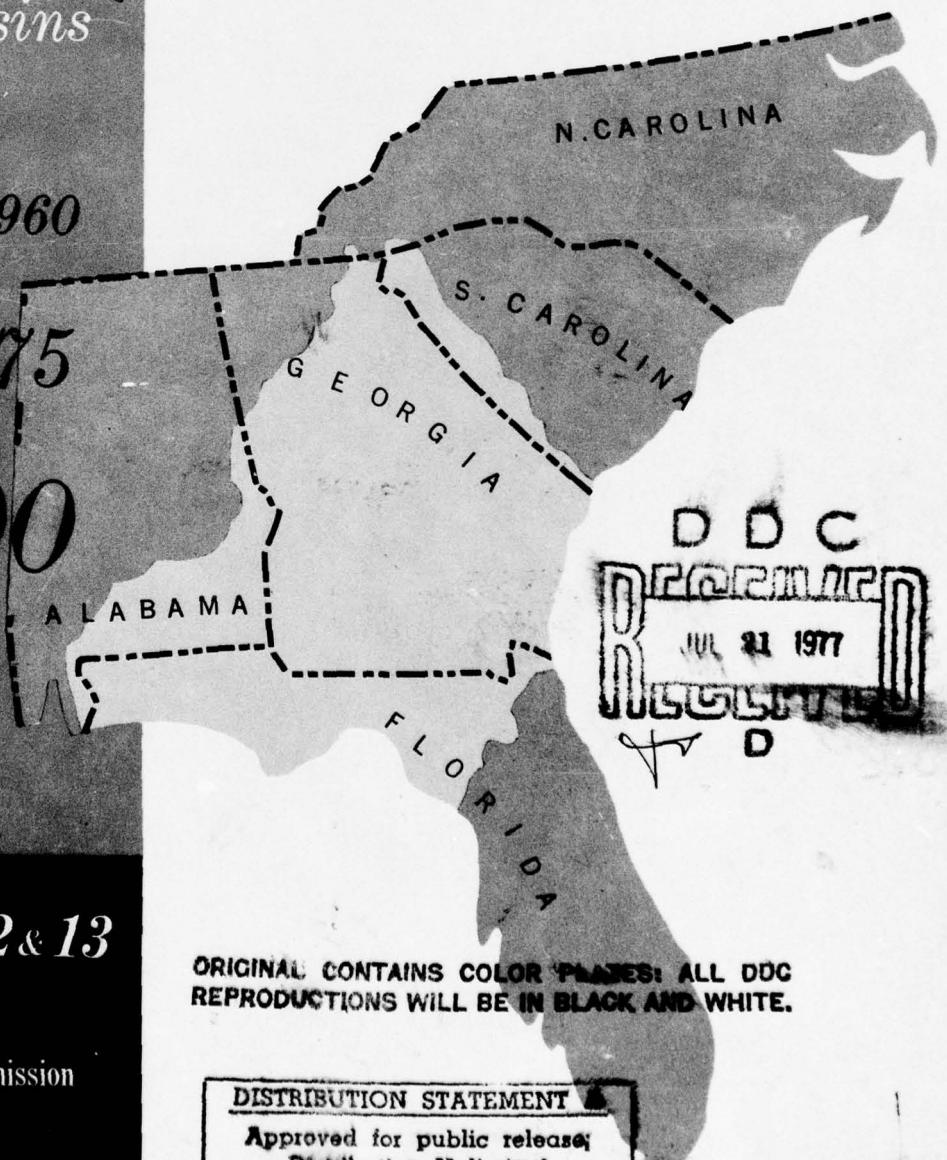
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APPENDIX 12
PLANNING

APPENDIX 13
**HISTORY AND
ORGANIZATION OF
THE COMMISSION**

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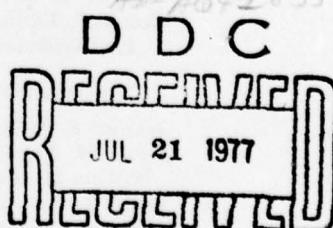
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TO REPORT OF
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SOUTHEAST RIVER BASINS

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FOREWORD

This Appendix to the Report of the United States Study Commission, Southeast River Basins, summarizes the studies made in formulating a comprehensive plan for the conservation, utilization, and development of the land and water resources of the study area.

The Planning Appendix includes a discussion of the procedures, criteria, and methods used in developing the comprehensive plan for conservation and development of the land and water resources in the Southeast River Basins. Data included in this Appendix are intended not to duplicate data or analyses in other appendixes; although summary statements of other appendix materials may be included for clarity and ready reference. Planning is described in this Appendix in three parts: Part One—Introduction; Part Two—Functional Planning; and Part Three—Comprehensive Planning. The matter contained in each part is pertinent to the comprehensive plan. The reader is urged to consider the Report in the aggregate rather than to consider selected material out of context.

The Report presents a plan made in response to the provisions of Public Law 85-850 (72 Stat. 1090) dated August 28, 1958, which established the United States Study Commission, Southeast River Basins. The authorizing Act provides for an integrated and cooperative investigation to formulate a comprehensive and coordinated plan for:

- (1) Flood control and prevention;
- (2) domestic and municipal water supplies;
- (3) the improvement and safeguarding of navigation;
- (4) the reclamation and irrigation of land, including drainage;
- (5) possibilities of hydroelectric power and industrial development and utilization;
- (6) soil conservation and utilization;
- (7) forest conservation and utilization;
- (8) preservation, protection, and enhancement of fish and wildlife resources;
- (9) the development of recreation;

- (10) salinity and sediment control;
- (11) pollution abatement and the protection of public health; and
- (12) other beneficial and useful purposes not specifically enumerated in the Act.

Under item (12), special studies were made of beach erosion control and hurricane protection, low-flow augmentation, and land transportation and landfill.

The comprehensive plan for the Southeast River Basins is formulated to meet the needs of the area for land and water resources development to the year 2000. Projects and programs existing and under construction in 1960 are included in the plan, but only 1960-2000 developments are analyzed.

The plan for the development of the resources of the Southeast River Basins is the result of cooperative work of Federal, State, and local and private agencies having interest in the area and knowledge of its needs and requirements. Public hearings were held early in the planning process to obtain firsthand knowledge of conditions and problems in the study area and to secure suggestions for their solution. Throughout the study, liaison was maintained with interested groups and agencies by means of conferences and committees, and advisory group meetings. When a tentative plan was developed public presentations were held by the Commission to inform interested persons and organizations and to request comments. These comments were considered in preparing the final plan and Report.

Although many individuals, groups, and agencies have participated in the studies, the Commission takes full responsibility for the plan, and for the projections, assumptions, and analyses on which it is based.

The Commission plan for the Southeast River Basins is supported by data contained in 13 appendixes. Data on the plan for development of the resources in the eight geographic areas studied in the Southeast River Basins are contained in Appendixes 1 through 8. Technical data and information applicable to both the entire study area and the several geographic

areas are contained in Appendixes 9 through 13. The appendixes to the Commission Report are as follows.

Appendix	Title
1	Savannah Basin
2	Ogeechee Basin
3	Altamaha Basin
4	Satilla-St. Marys Basins
5	Suwannee Basin

Appendix	Title
6	Ochlockonee Basin
7	Apalachicola-Chattahoochee-Flint Basins
8	Choctawhatchee-Perdido Basins
9	Economics
10	Hydrology
11	Engineering and Cost
12	PLANNING
13	History and Organization of the Commission

**U. S. STUDY COMMISSION
SOUTHEAST RIVER BASINS**

**APPENDIX 12
PLANNING**

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THE SOUTHEAST RIVER BASINS

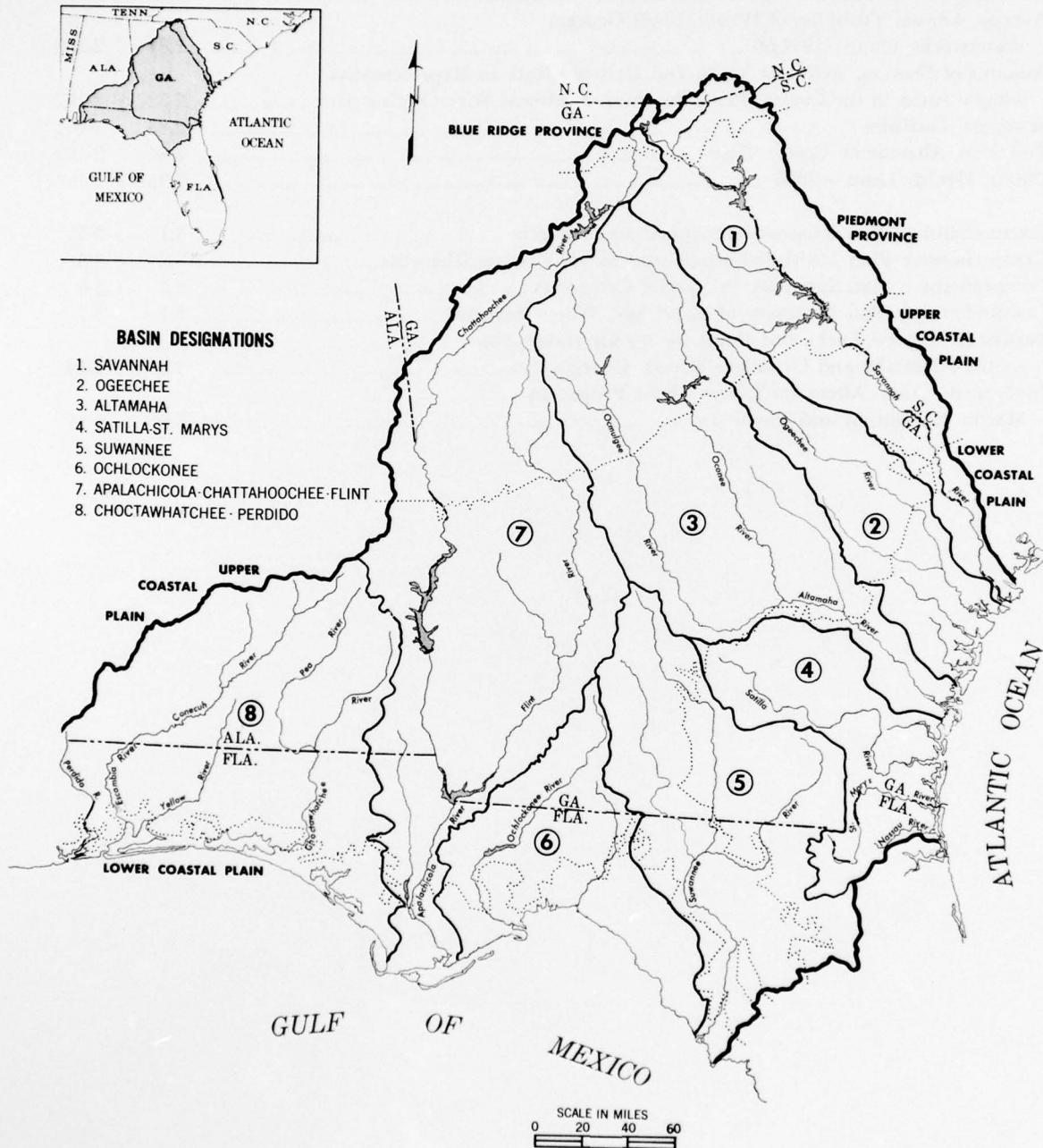


Figure 1.1

PART ONE - INTRODUCTION

SECTION I - COMMISSION APPROACH

Study Area

The 88,000-square-mile study area includes portions of the four States mentioned in the Act and, in addition, a small part of the State of North Carolina.

The eight subareas or basins into which the study area is divided are shown with number designations on the frontispiece. The boundaries of these basin segments correspond to the natural drainage divides of the major streams and tributaries except in the lower coastal reaches where the dividing lines are extended to the coast to include the short coastal streams. As indicated on the map, the study area includes three physiographic provinces: The Blue Ridge, the Piedmont, and the Coastal Plain—Upper and Lower.

Commission Objective

The objective of the Commission has been to ascertain the maximum contribution of the resources of the study area to the future development, strength, and general welfare of the region, as well as the Nation. Specifically, this involves the making of an integrated and cooperative investigation, study, and survey, and the formulation of a comprehensive and coordinated plan as a means of assuring optimum, sustained use of the land and water resources of the region in the light of the overall requirements.

Guiding Concepts

The Commission is a planning body with no responsibilities for construction or operation of projects or programs. The staff was a small supervisory and coordinating group which utilized the services of qualified existing agencies and individuals to the maximum extent. These existing agencies included Federal departments, State organizations, and private entities.

The authorizing Act consistently refers to land and water resources. There is no indication that one type of resource is to be considered

more important than another or that any one of the listed purposes is to be subordinate to any of the others. Therefore, a basic concept in planning was the equal status of all the purposes, whether land or water oriented, to meet projected needs.

It is stated in the Act that it shall be the policy of the Congress to recognize the primary responsibilities of the States and local interests in developing water supplies for domestic, municipal, industrial, and other purposes, and that the Federal Government should participate and cooperate with the States and local interests in developing such water supplies in connection with the construction, maintenance, and operation of Federal navigation, flood control, irrigation, and multiple-purpose projects.

Advisory groups were organized to serve the Commission within the general spheres of land, water, and economics.

More detailed information on guiding concepts are contained in other appendixes, especially Appendix 13, History and Organization of the Commission, and in Part One of Appendix 9, Economics.

In the Commission work, the term comprehensive is used to cover, insofar as possible, matters of concern to the purposes listed in the Act. Coordinate is used in the sense of bringing into common action. Integrate is in the sense of making a unit. Functions and purposes are used as synonymous terms.

General Planning Procedure

The overall planning procedure included four fundamental steps: (1) An inventory of resources; (2) an analysis and projection of the needs as of certain future dates; (3) preparation of single-purpose ways of meeting needs for each function; and (4) formulation of a comprehensive plan.

The division of the study area into eight basins or subareas, each with its own scheduled study completion date and its own requirement

for planning data, made it possible to carry on much of the work of the four steps concurrently. But even for a single basin study, the steps tended to merge to a considerable extent because of the necessity for revision and refinement as the work progressed.

In applying the four fundamental planning steps, the studies were carried out in three general categories. One of these categories was basin or area studies; another was purpose or functional oriented studies; and a third consisted of basic studies.

Basin or area studies were oriented toward areal units consisting of the eight basins and the study area as a whole. The basin studies culminated in formulation of a resource development plan. Ascertaining local conditions and obtaining local views were an important part of the basin studies. The area or basin studies are covered, in the main, in Part Three — Comprehensive Planning of this Appendix and in Appendixes 1-8, inclusive, dealing with the eight basins.

Functional- or purpose-oriented studies parallel the listing in Public Law 85-850 and are described in Part Two of this Appendix.

Basic studies are the broad type of investigations which are applicable in several basins and to several purposes or functions. Because the end purpose of all of the Commission studies

was directed toward an integrated comprehensive plan, it was essential that data be compatible. Basic studies using common denominators contributed to compatibility. The results of basic studies by subjects listed below were used as needed in the several basins and in the functions.

The subjects are covered in more detail in Appendixes 9 and 10 as noted below.

Appendix 9

Transportation
Population
Income
Employment
Special Industry Studies
Minerals
Nonagriculture
Agriculture
1960 Water Use
Soil Conservation Needs Inventory
Leisure Time

Appendix 10

Hydrological Characteristics
of the Study Area
Water Quality
Ground Water
Flood Forecasting

SECTION II – WORKING BASIS

The working basis upon which the planning activities are founded includes not only the Commission approach, the Commission objective, the guiding concepts, and the general planning procedure covered in the preceding Section, but also depends upon other general policy guides and assumptions. Part One of Appendix 9, Economics, develops these matters in considerable detail especially as they are related to the economic phases of the study. The objectives and guidelines are described in terms of the conceptual framework including general objectives, specific economic objectives, planning guidelines, and general methodology. The principal economic guidelines include some primary indicators which were used in projecting the economic growth in the Southeast River Basins

area and in determining needs to be served by the comprehensive plan. These indicators are population, employment, and income. In addition, Appendix 9 includes a section on assumptions and sections on application of policies and practical considerations in carrying out the work. Also, Appendix 9, Part Three, includes an economic framework setting forth projected data to which other studies are correlated.

In brief form the basic assumptions and policies that are especially pertinent to planning are summarized below.

Assumptions

In view of the large numbers of individuals, institutions, organizations, and agencies partici-

pating in the development of basic data, projections, and plans, it was particularly important that all studies should utilize the same guidelines and controlling criteria. The plan of the Commission is based on a set of controlling assumptions and working procedures arrived at after much deliberation and careful consideration by staff members, cooperating agencies, consultants, steering groups, and work group members.

The basic general assumption adopted concerning population was that the national population will continue to increase at a rate reflected by the following assumptions: (1) The present fertility level, 1955-57 average, will remain constant to 1975-80, then decline to the 1949-51 level by 2005-2010; (2) there will be moderate declines in mortality to the end of this century; and (3) net migration from abroad will be constant at about 300,000 per year.

Projections of State and area population were made in conformance with the national population assumptions but with primary regard to conditions reflected by study and analysis of the Southeast River Basins area. This led to the assumption that migration may be expected to shift from a negative to a positive force in the Southeast River Basins area population growth around 1980.

With regard to the general economic environment, the assumptions are that there will be a continued upward trend in employment and production, with higher per capita income, and for analysis purposes, a stable general price level is assumed at the national level. The upward trend in population, employment, and production will be accompanied by upward trends in total volume of consumption and international trade. This will be accompanied by a continued trend toward relative stability of the international situation with no significant worsening of the cold war and no widespread outbreak of hostilities. It is further assumed that government policies and programs will be consistent with the foregoing assumptions to the extent that economic growth and development of resources necessary to that growth will continue to be implemented and encouraged.

In conjunction with these basic assumptions, a further premise is that the economy of the Southeast River Basins area and the Nation will

continue to be based on a free enterprise system with the Federal Government and non-Federal interests cooperating in encouraging and implementing economic growth and development throughout all segments of society and all areas of the Nation.

Additional assumptions are that:

(1) Preliminary economic projections will be made under the assumption that land and water will be available for the proper development of other resources in the Southeast River Basins area as a whole;

(2) a stable general price level will be assumed and all cost and benefit values used throughout the studies will be expressed in constant dollars;

(3) prices prevailing during an appropriate period ending approximately January 1960 will reflect both the general level of prices as well as price relationships anticipated during the planning period, with the exception of agricultural commodity prices which it is assumed will rise to a parity level of 89. Minor adjustments were also made in anticipation of some increase in the price of a few farm production items, particularly labor;

(4) the level of education, training, and skills of the people generally and the labor force specifically will continue to improve;

(5) investment capital required to attain projected industrial growth and resource development will be available;

(6) consumer incomes will have risen to such a level by 1975 that most consumers in the United States will be eating the kind and amount of food they desire, and changes in per capita demand for farm products due to changes in income will be negligible after 1975;

(7) an unemployment rate of about 4 percent of the civilian labor force in the Southeast River Basins area will prevail during the projection period; and,

(8) the per capita income gap that exists between the Southeast River Basins area and the Nation will continue to close at a rate comparable to that experienced from 1948 to 1957. Under this assumption, the per capita income gap as expressed in percentage of the Southeast River Basins area to the Nation is projected to close from 71.2 percent in 1960 to 82.9 percent in 2000.

Priority of Policy and Guideline Statements

As studies progressed and the need for consistency in application of policies and procedures became more apparent, the following priority list was established for application of various policy statements, procedures, and agreements. A number of specific policy guidelines were established in order to provide specific direction and guidance on the numerous subjects of concern.

- (1) U. S. Study Commission policy statements.
- (2) Functional and basic work plans, technical supplements, and work agreements or contracts and written instructions from the U. S.

Study Commission, within the framework of (1) above.

(3) Report of the Federal Inter-Agency Committee on Water Resources, "Proposed Practices for Economic Analysis of River Basin Projects," prepared by the Subcommittee on Evaluation Standards, May 1958, for economic aspects of planning only.

(4) Agreements between agencies having primary interest in the matter under consideration other than jurisdictional.

(5) Manuals or other policy and procedural statements of the cooperating agencies.

(6) Current practice of the cooperating agency.

PART TWO - FUNCTIONAL PLANNING

The primary purpose of Part Two is to describe what was done and by what group for each of the purposes listed in the authorizing Act. Also included is summarized data on the study results for each purpose. Information on how and why certain work was done is covered as appropriate for clarity but emphasis is not placed upon how and why.

Sections I through IV cover matters that are

applicable to all of the purposes and each of the other Sections, V to XVI inclusive, deals with a purpose specified in the authorizing Act. For each purpose there is coverage of the study concept, work plans, work performance, coordination, findings, a summary of the special part of the comprehensive plan, and a bibliography. Also, there are supplemental materials, at the end of some sections.

SECTION I - FUNCTIONAL STUDY OBJECTIVES

The main objective of the functional- or purpose-oriented studies is to assemble data on: (1) The inventory of resources and existing development; (2) the needs, present and projected; and (3) the single-purpose ways of meeting the needs. Compilation of information served as a means of organizing the mass of data which was considered in formulating the comprehensive, integrated, multiple-purpose plan. Also, compilation of information by purposes from several sources helped avoid an ever-present possibility of having data limited to that considered feasible or valid under special rules or laws peculiar to a single agency or group.

Inventory information includes both the physical natural resources and existing developments. Unless specified otherwise, existing is used to apply to developments installed and under development as of 1960.

Needs and the satisfaction of them are the essence of the plan and the planning studies. The term needs is used in the sense of a condition requiring supply or relief; and needs are considered from the viewpoint of the people; that is, human needs and desires. The projected

magnitude of the population, together with its characteristics, was, therefore, fundamental in establishing resource development needs. Growth in needs was, in general, assumed to follow the growth trend in population, employment, personal income, or some derivative of these factors. In contrast, needs in the sense of forests being protected from fire or wildlife needing improved habitat for the sake of forests or wildlife alone are not a part of the plan and are considered only as derivatives of human needs.

Needs covered in the discussion of each purpose include those existing and satisfied as of 1960 as well as unsatisfied needs as of 1960. Projected needs cover the expected changes projected to the year 2000 with 1975 as an intermediate date. Benefit and cost data cover only the increment of the plan to be developed during the period 1960-2000.

Single-purpose alternatives are ways of meeting needs with the available resources without considering the competitive, beneficial, and corollary tempering influences of other functional plans. These alternatives are useful in formulating the comprehensive plan.

SECTION II - STANDARDS AND CRITERIA

In establishing standards, definitions, and criteria essential in collecting data for planning resource developments, the practice generally followed by the appropriate profession, discipline or agency concerned has been used with a few exceptions. For example, in forestry mat-

ters, terminology and standards commonly used by foresters have been used. A complete listing would include many other examples.

Whenever conflicting practices within a professional discipline were recognized or if there was variance between agencies primarily con-

cerned with a function, special standards, definitions or criteria were adopted to be used in Commission work. When special definitions and criteria were necessary, care was taken to stay within the framework of the Commission adopted policies.

It should be recognized that standards, criteria, and definitions are basic to the work plans for the studies and for usable study results. In the following sections on the purposes, special standards and definitions are identified if used.

It was impracticable and undesirable for the Commission to review and revise completely the multitude of policies, practices, and procedures of planning which have been established by resource development agencies over a period of many years. The Commission and cooperating agencies used the priority listing described in Part One for guidance as to standards, definitions, and criteria in the planning of projects and programs for resource development included in the comprehensive plan.

SECTION III - WORK PLANS

A work plan is a document that established the broad framework within which a specific purpose was studied. A separate work plan was prepared for each function. Technical supplements are documents prepared to show additional details of studies in the work plans but were not prepared for all functions.

Following staff review, a draft work plan was referred to the appropriate Land, Water, and Economics Groups of the Commission. These groups were organized by the Commission with the main purpose of rendering advice on the studies. The work plan draft was sent in advance to the group members which enabled the members to examine the material prior to the meeting and to consult with members of their own organization. Outside viewpoints and variety of experience thus were considered in the plan which helped assure depth and perspective and helped eliminate inadvertent omission from the tasks contained in the study. After consideration of the plan by the appropriate group, the group chairman sent the work plan to the Executive Director with recommendations.

In addition, some functional committees gave advice on work plans. Appropriate State and Federal officials who are concerned with a particular function, and private organizations, businesses and groups that include persons qualified in many speciality fields were consulted. For example, the editor of a technical forestry magazine was consulted on the Forestry Work Plan; and a member of the Wildlife Management Institute was consulted on the Fish and Wildlife Work Plan. The purpose of this particular step was to assure that the best advice available was received and incorporated in the work plan.

Individual Commissioners sought comments and suggestions from the agencies in their department or State. In this manner, the Commission members were informed as were the agencies. Even though a given agency was consulted by the staff during the drafting of the work plan and the agency representatives participated in the group review, it was possible that the work plan contained some elements that the policy or practice of a specific agency regarded as undesirable from an agency viewpoint.

SECTION IV - WORK PERFORMANCE

Negotiations were undertaken with appropriate agencies, State and/or Federal, and with private groups to perform the tasks outlined in the work plan. There was a variation among functions as to how the work was accomplished, but usually several agencies or groups participated in studies on each function.

Work specifications, timing, and financing arrangements were negotiated and made a matter of record in a contract or agreement. Generally,

contracts were between the Commission and a State agency, university, or private group. Agreements were arranged between the Commission and other Federal entities. Contractual arrangements and agreements ranged from an informal exchange of letters to formalized contracts or signed agreements.

The functional study results were given to the Commission in the form of reports that ranged from simple letter-reports to formalized,

bound and printed volumes. These reports on functional studies, irrespective of the exact form, were each termed a technical memorandum.

A functional memorandum was prepared for each function for each basin. Some are merely the collection of technical memoranda; others are prepared by extracting selected results from the technical memoranda. The purpose of the functional memorandum was to provide pertinent material in an organized form for each

basin for use in evolving and formulating a comprehensive basin plan. In practice, the longer the staff members worked together the less formal the functional memorandum became. Eventually the plans were formulated through frequent discussion, analysis, and informal teamwork.

A terminal study is the term used to describe the studies to obtain additional data on tentative plan proposals. Information for each function is covered in subsequent Sections.

SECTION V – FLOOD CONTROL AND PREVENTION

General Concept

Flood control and prevention studies deal mainly with the possibilities of alleviating present flood damage conditions and minimizing the increased flood damage that could result from expected more intensive use of flood plain lands.

Although basin plans include physical works of improvement only, the importance of flood plain management is recognized. Flood plain management is an important segment of flood control to be considered in carrying out any program for flood control and prevention. Detailed studies are required to make adequate flood plain management proposals, and such studies would be very costly and time consuming. Because of the uncertainties of estimating future flood plain development, it is more practical to make a general study of flood plain management and then make the findings available to agencies and local groups who might need such information. Basin plans include statements of the importance of flood plain management but do not outline proposals.

Need for flood control and drainage on an area often overlaps, particularly in the Lower Coastal Plain; and measures that provide relief for the two problems are considered dual purpose.

Data on flood-producing storms, floods, rainfall-runoff relations, flood volumes, and flood peak magnitudes are discussed in detail in Appendix 10, Hydrology.

Work Plan

A first step in planning for flood control and prevention was the development of a work plan that outlined the various steps needed to com-

plete necessary studies in the available time. Items covered in the work plan included: (1) Standards, definitions, and criteria; (2) technical tasks; and (3) technical assignments. A copy of the work plan is included at the end of this Section.

The work plan was never formally revised, but in practice it was modified by deletions and additions during the study period.

Work Performance

Many agencies, organizations, and individuals helped develop material and recommendations needed to plan for flood control and prevention. Some work was done by contract and some by agreement. Much data were voluntarily contributed, and the Commission staff undertook many studies and analyses.

A joint agreement was entered into by the Commission with the U. S. Department of Agriculture, Soil Conservation Service, and the U. S. Army, Corps of Engineers, for flood control studies. Areas to be studied were divided between the Soil Conservation Service and the Corps of Engineers by designating on a map the river reaches which would be studied specifically by the Corps of Engineers. These reaches generally covered the main stream and the lower parts of the large tributaries in each basin. The Soil Conservation Service covered all stream reaches not directly assigned to the Corps of Engineers. Each agency made use of data that it had gathered in the past. Flood damage data were updated and adjusted where necessary. Field studies were made when necessary to obtain supplemental data.

A contract was made with a consulting engineer to make a flood plain management study

for the Southeast River Basins. The study was aimed primarily at pointing out what is required to initiate and carry out flood plain management. Cities, towns, and communities where flood plain management appears especially necessary are noted on Figure 2.1. There are also many more locations where similar needs exist. The consultant's report on flood plain management has been reproduced, is being distributed to State and Federal groups with interest in this type of activity, and is available in the supporting files of the Commission.

Coordination

After the work plan was prepared and arrangements made to obtain necessary data, the process of consolidating flood control data and information was started. A Flood Control Committee that included U. S. Department of Agriculture and U. S. Department of the Army personnel was organized to consider and help evaluate flood control data and findings. The Land, Water, and Economics Groups also considered the flood control aspects of the basins studies during their deliberations.

The Commission worked with the appropriate U. S. Department of Agriculture and U. S. Department of the Army offices to facilitate the development of a flood control plan. During the study, additional assignments of work were made to help insure that the parts would fit into the ultimate flood control plan.

For example, it was recognized that the up-

stream watershed program would have some effect on the flow of downstream reaches being studied by the Corps of Engineers. Conferences were arranged with the Soil Conservation Service and the Corps of Engineers to determine which of the basins would require flood routing to reflect upstream watershed programs. These basins were the Savannah, the Altamaha, the Suwannee, and the Apalachicola-Chattahoochee-Flint. In each basin, the Corps of Engineers, after consulting the Commission and the Soil Conservation Service, selected flood events to be routed. Floods were analyzed by reaches to determine the local inflow to each reach and to develop a system of flood routing throughout the entire basin. The Corps of Engineers furnished the results of their flood routing to the Soil Conservation Service who then estimated the effect upstream watershed programs would have on the local inflow hydrograph. The Soil Conservation Service then furnished the Corps of Engineers a modified local hydrograph for each reach which contained upstream watershed projects suggested for inclusion in the Commission plan. The Corps of Engineers then routed the modified flows furnished by the Soil Conservation Service. Routings were made separately and in combination with structural projects. The Corps of Engineers furnished to the Commission and to the Soil Conservation Service the results of their studies including estimates of downstream benefits which would accrue to the upstream watershed program.

CITIES, TOWNS, AND COMMUNITIES IN THE SOUTHEAST RIVER BASINS AREA WHERE FLOOD PLAIN MANAGEMENT SHOULD BE CONSIDERED

1 Athens, Georgia	19 Doctortown, Georgia	37 Bainbridge, Georgia
2 Atlanta, Georgia	20 Cox, Georgia	38 Marianna, Florida
3 North Augusta, South Carolina	21 Albany, Georgia	39 Westville, Florida
4 Augusta, Georgia	22 Gantt, Alabama	40 Milligan, Florida
5 Hamburg, South Carolina	23 River Falls, Alabama	41 Caryville, Florida
6 Milledgeville, Georgia	24 Andalusia, Alabama	42 River Junction, Florida
7 West Point, Georgia	25 Elba, Alabama	43 Callahan, Florida
8 Lanett, Alabama	26 Everett City, Georgia	44 Milton, Florida
9 Macon, Georgia	27 Columbia, Alabama	45 Blountstown, Florida
10 Dover, Georgia	28 Newton, Georgia	46 Ellaville, Florida
11 Dublin, Georgia	29 Nashville, Georgia	47 Bristol, Florida
12 Columbus, Georgia	30 Waycross, Georgia	48 White Springs, Florida
13 Phenix City, Alabama	31 Atkinson, Georgia	49 Suwannee Springs, Florida
14 Montezuma, Georgia	32 Geneva, Alabama	50 Dowling Park, Florida
15 Americus, Georgia	33 Brewton, Alabama	51 Perry, Florida
16 Eufaula, Alabama	34 East Brewton, Alabama	52 St. Marks, Florida
17 Ludowici, Georgia	35 Pollard, Alabama	53 Branford, Florida
18 Townsend, Georgia	36 Flomaton, Alabama	54 Wilcox, Florida

CITIES, TOWNS AND COMMUNITIES WHERE FLOOD PLAIN MANAGEMENT SHOULD BE CONSIDERED

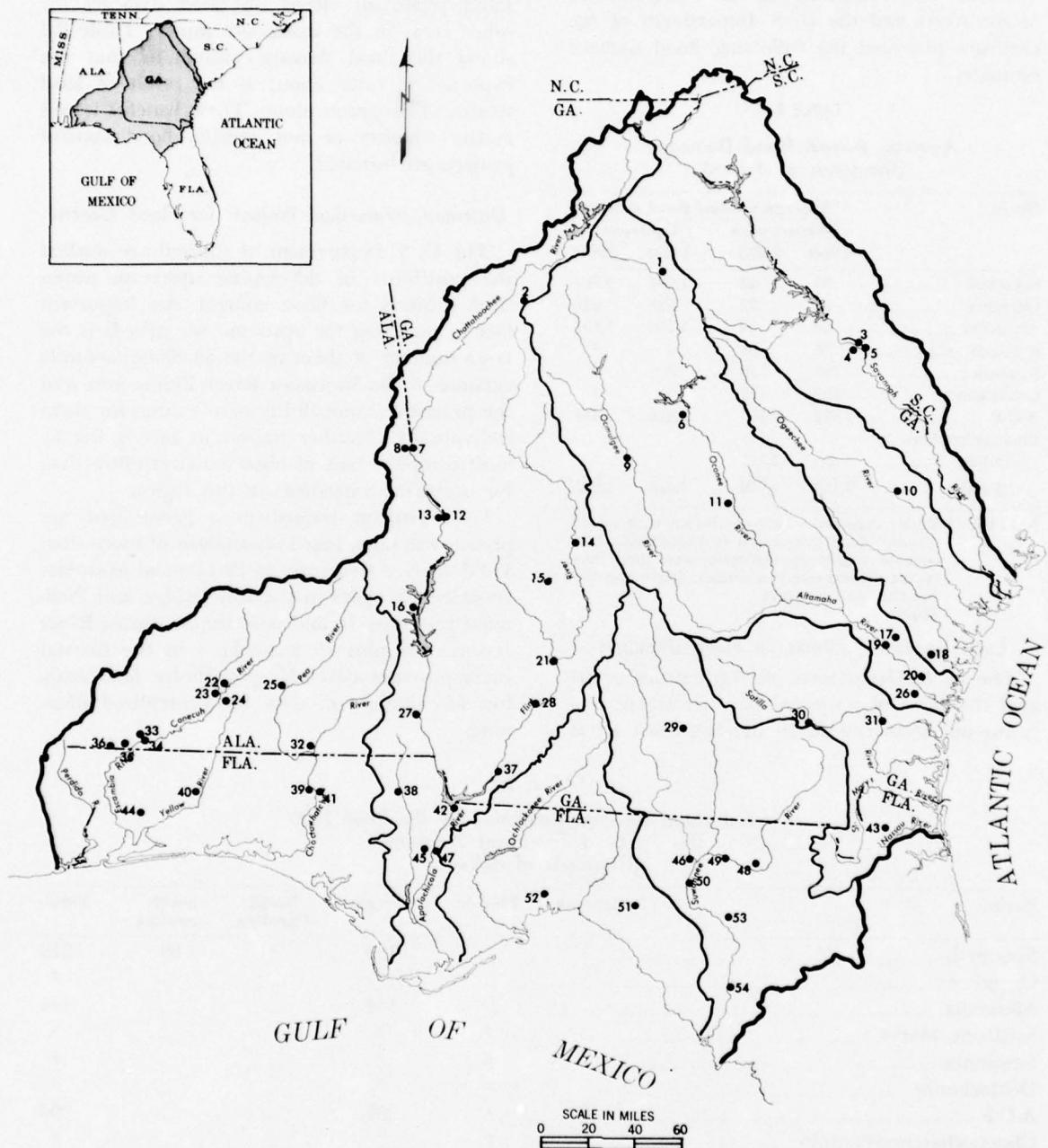


Figure 2.1

Findings

Present and Projected Flood Damage "Without" Additional Protection

Studies undertaken by the U. S. Department of the Army and the U. S. Department of Agriculture provided the following flood damage estimates.

TABLE 2.1

Average Annual Flood Damages (thousands of dollars)

Basin	Average annual flood damage			
	Mainstream		Upstream	
	1960	2000 ¹	1960	2000 ¹
Savannah	32	42	1,783	1,783
Ogeechee	22	22	231	231
Altamaha	68	80	1,194	1,194
Satilla-St. Marys	28	38	2	2
Suwannee	100	232	2	2
Ochlockonee	101	192	2	2
A-C-F	1,072	2,802	2,414	2,414
Choctawhatchee-Perdido	695	1,541	2	2
Total	2,118	4,949	5,622	5,622

NOTES: ¹ Under expected future conditions with no additional flood prevention or protection. Damageable values on upstream watershed flood plains are expected to remain fairly constant for the next 40 years.
² Minor.

Land Treatment Effects on Flood Damages

The U. S. Department of Agriculture evaluated the effect of projected land treatment programs on storm runoff. In the Southeast River

Basins, land treatment can result in appreciable flood reduction benefits, particularly for areas where impoundment structures in conjunction with channel improvement are generally feasible. Land treatment effects on flood damages for other areas in the basins are minor. Table 2.2 shows the flood damage reductions that are expected to come about as the result of land treatment programs alone. These benefits would accrue whether or not specific flood control projects are initiated.

Upstream Watershed Projects for Flood Control

The U. S. Department of Agriculture studied the possibility of developing upstream watershed projects for flood control. An important fact in planning for upstream watersheds is the large number of them in the 88,000-square-mile expanse of the Southeast River Basins area and the practical impossibility of planning for them individually. Another important fact is the almost complete lack of observed streamflow data for upstream watersheds in this region.

For upstream watersheds a generalized approach was used, based on analysis of more than 150 detention structures in 20 planned upstream watershed projects in the Blue Ridge and Piedmont provinces in and near the Southeast River Basins area plus 10 watersheds in the Coastal Plain province selected especially for field study for development of data for generalized planning.

TABLE 2.2
Annual Flood Damage Reduction by the Year 2000
Due to Land Treatment Programs¹
(thousands of dollars)

Basin	Alabama	Florida	Georgia	North Carolina	South Carolina	Total
Savannah	--	--	136	2	80	216
Ogeechee	--	--	2	--	--	2
Altamaha	--	--	144	--	--	144
Satilla-St. Marys	--	2	2	--	--	2
Suwannee	--	2	2	--	--	2
Ochlockonee	--	2	2	--	--	2
A-C-F	3	2	287	--	--	290
Choctawhatchee-Perdido	2	2	--	--	--	2
Total	3	2	567	2	80	650

NOTES: ¹ Includes all planning unit watersheds studied regardless of whether they are included in the plan for project action or not.
² Minor.

Table 2.3 contains benefit cost data on proposed upstream watershed projects.

The Coastal Plain watersheds were selected by experienced agricultural people, both local and U. S. Department of Agriculture. Selections of the areas were made on the basis of land use, types of flood damage, topography, soil type, and other existing conditions. For the Coastal Plain province, sample watersheds were evaluated and the findings were applied to watersheds which were considered representative for expansion purposes. Cost and benefit data for each sample watershed were reduced to an acre-benefited figure which could then be used for expansion purposes.

Sample watershed detention structures in the Piedmont and Blue Ridge provinces have drainage areas from less than 1 square mile to about 15 square miles with 75 percent being less than 5 square miles. The mean drainage area of a typical floodwater retarding structure is 2.5 square miles. The average sample watershed has approximately 45 percent of its total area controlled by floodwater retarding structures. Average cost of the works of improvement for flood control per square mile of drainage area controlled by floodwater retarding structures for the sample areas in the Blue Ridge and Piedmont provinces is \$15,000. It was also found that in most of these watersheds a limited

amount of channel improvement below the floodwater retarding structures is needed. The average cost for this type work is \$6,087 per square mile of drainage area not controlled by a floodwater retarding structure.

The total channel installation cost for the joint purpose of flood prevention and drainage was obtained by multiplying the larger of the two acreages, flood prevention and drainage, by the installation cost per acre of the applicable sample. The flood prevention and drainage acreages are those acres shown in the U. S. Department of Agriculture Conservation Needs Inventory under the headings Floodwater and Sediment Damage Reduction Acreage Needing Project Action and Drainage Acreage Needing Project Action. Total installation cost was divided between purposes in proportion to the ratios of areas requiring project action for each of these purposes. This is illustrated as follows:

C — Cost of joint purpose channel

D — Area with a drainage problem requiring project action

F — Area with a flood prevention problem requiring project action

$\frac{F}{(D + F)} \times C =$ Estimated cost of flood prevention portion of channel

The annual operation, maintenance, and replacements costs were obtained in the same way

TABLE 2.3
Flood Control Benefits and Allocated Costs —
Proposed Upstream Watershed Projects

Basin	1960 — 2000 Program (\$1,000)				Area in pro- posed projects (1,000 acres)	
	Benefits Annual ¹ equivalent	Costs				
		Total	OM&R ²	Investment		
Savannah	2,989	2,146	572	43,420	2,500	
Ogeechee	181	90	17	2,007	278	
Altamaha	1,173	749	180	15,700	1,100	
Satilla-St. Marys	1,323	295	70	6,260	1,400	
Suwannee	743	177	41	3,774	2,100	
Ochlockonee	457	350	77	7,580	1,600	
A-C-F	2,500	1,242	309	24,800	1,900	
Choctawhatchee-Perdido	64	51	15	988	900	
Total	9,430	5,100	1,281	104,529	11,778	

NOTES: ¹ Benefits evaluated after the flood damages were reduced to reflect the effect of land treatment on flood damages.

² Annual equivalent operation, maintenance, and replacements costs are the same as the operation, maintenance, and replacements costs at year 2000.

as the installation cost except that the operation and maintenance costs per acre were used in the computations.

Benefits from the upstream watershed programs will accrue as the result of restoring the land to its former use, changing the use of the land, using the land more intensively, and reducing floodwater damage.

Mainstream Flood Control

For large drainage areas, the Corps of Engineers estimated flood frequency characteristics for flood-damage sites or reaches by preparing flood frequency curves from recent floods which covered a good range of magnitude, or in some instances from an array of synthetic floods which cover a range of frequency.

Average annual flood damages for large drainage areas were estimated by combining stage-discharge, discharge-frequency, and stage-damage curves to obtain damage-frequency curves and then measuring the area under the curves.

Flood damages on the main rivers and tributaries are scattered and generally not large enough to justify the costly projects required to alleviate the conditions. The inclusion of flood control storage in reservoirs proposed for other purposes often affords an opportunity for providing flood protection and these possibilities were investigated. The single-purpose or multiple-purpose projects included in the plan for flood control are shown in Table 2.4.

Single-Purpose Plan

The single-purpose plan for flood control and prevention included only the upstream watershed projects of the Piedmont and Blue Ridge provinces and a number of levees. Reservoirs for protecting damage areas on the main streams could not be justified for flood control alone. Flood control and drainage problems in the Coastal Plain province were planned jointly where the problems overlapped.

The single-purpose upstream watershed projects of the Piedmont and Blue Ridge provinces are generally included in the comprehensive plan without modification or consideration of other purposes. Features of the upstream watershed projects, particularly floodwater retarding structures, could and undoubtedly will be used for other purposes. However, because project

TABLE 2.4
Benefits and Allocated Costs of Mainstream Flood Control Projects
(thousands of dollars)

Basin and project	Benefits Annual equivalent	Costs		
		Total	Annual equivalent	Investment OM&R ¹
Altamaha				
Townsend	458	280	114	4,610
Satilla-St. Marys				
Nassau River Embayment	40	31	9	620
Suwannee				
Alapaha	23	23	9	400
Ashburn	2	1	2	24
Moultrie	2	1	2	30
Nashville	8	3	2	69
Quitman	5	4	1	86
Shiloh	40	35	7	756
Tifton	2	2	1	33
Ochlockonee				
Thomasville	1	1	2	19
St. Marks Levee	13	9	1	220
A-C-F				
Cedar Creek	399	327	88	6,600
Columbus-Phenix				
City	778	282	22	7,200
Kinchafoonee	80	70	19	1,400
Lazer Creek	82	63	3	1,660
Lower Auchumpkee	380	343	29	8,700
Muckalee	45	39	6	900
Spewrell Bluff	667	583	45	14,950
West Point	747	644	40	16,700
Flood control levees	462	251	65	5,200
Choctawhatchee-Perdido				
Ariton	390	196	26	4,735
Brewton Levee	29	27	2	684
Flomaton Levee	45	27	5	619
Total	4,698	3,242	492	76,215

NOTES: ¹ Annual equivalent operation, maintenance, and replacements costs are the same as the annual operation, maintenance, and replacements costs at year 2000.

² Minor.

proposals are based on expansion of results of watersheds studied to date, and because no attempt was made to locate specific structure sites, plans for other purposes are not specifically included. As watershed projects are planned and constructed, studies should be made to determine how advantageously needs for other purposes could be met by development of a multiple-purpose project. If needs for purposes other

than flood control are then included in upstream projects, the plans for the other purposes should be modified to account for this use.

Comprehensive Plan

The comprehensive plan includes specific proposals for flood control and prevention as well as statements on the value and need for flood plain management. Table 2.5 summarizes costs and benefits of projects that are included in the plan.

TABLE 2.5

Flood Control Benefits and Costs — Total Program (thousands of dollars)

Basin	Benefits		Costs	
	Annual equivalent	Total	Annual equivalent	Investment
		OM&R*		
Savannah	2,989	2,146	572	43,420
Ogeechee	181	90	17	2,007
Altamaha	1,631	1,029	294	20,310
Satilla-St. Marys	1,363	326	79	6,880
Suwannee	825	246	59	5,172
Ochlockonee	471	360	78	7,819
A-C-F	6,140	3,844	626	88,110
Choctawhatchee-Perdido	528	301	48	7,026
Total	14,128	8,342	1,773	180,744

* Annual equivalent operation, maintenance, and replacements costs are the same as the annual operation, maintenance, and replacements costs at year 2000.

Bibliography

The following were prepared for the U. S. Study Commission, Southeast River Basins:

Fry, Albert S. *Flood Plain Management for the Southeast River Basins*, June 1962. This report defines and discusses flood plain management and gives information on (1) need for flood plain management in the Southeast River Basins, (2) who can make and how communities may obtain engineering reports, (3) a typical engineering report, (4) how to carry out and what to consider in planning studies, (5) the authority of flood plain regulation, (6) alternative or supplementary measures, and (7) reservoir land management.

U. S. Army. *Flood Control Studies for the Southeast River Basins*, Corps of Engineers. Separate reports were prepared for the rivers in the basins and were forwarded under different titles. A list of the separate reports follows:

Savannah River	Nassau River
Ogeechee River	Suwannee River
Altamaha River	Ochlockonee-St. Marks Rivers
Satilla River	A-C-F Rivers
St. Marys River	Choctawhatchee-Perdido Rivers

U. S. Department of Agriculture. *Technical Memorandum on Flood Control*, Soil Conservation Service; separate reports by basins, as follows:

- Basin No. 1 Savannah — April 1961
- Basin No. 2 Ogeechee — February 1961
- Basin No. 3 Altamaha — April 1961
- Basin No. 4 Satilla-St. Marys — February 1961
- Basin No. 5 Suwannee — March 1961
- Basin No. 6 Ochlockonee — March 1961
- Basin No. 7 A-C-F — May 1961
- Basin No. 8 Choctawhatchee-Perdido — April 1961

Supplemental Data

The work plan for flood control studies follows. Other flood control data are included in the files of the U. S. Study Commission, Southeast River Basins.

WORK PLAN — FLOOD CONTROL

(edited to delete administrative details)

I. *Introduction* — Public Law 85-850 requires the formulation of a comprehensive and coordinated plan for several purposes including "flood control and prevention." The final plan of the Study Commission will integrate these several purposes so that each function will participate to such an extent that the total benefits produced will be a maximum. The development of new flood protection facilities will include the incorporation of existing, under construction, and authorized projects into the comprehensive plan. In developing the plan for new facilities, it is desirable that all possible ways be considered for alleviating the impact of floods on the use of flood plains. Three general ways by which the formation of floods within a basin and their passage through a river system may be influenced are as follows: one, development of forest and soil conservation programs so as to obtain optimum basin hydrologic conditions; two, development of plan for flood forecasting, flood plain zoning, floodway planning and regulation, and evacuation of flood plain to reduce the economic impact and loss of life from passage of floods through the flood plains; and three, development of plan of reservoirs to detain flood runoff and levees and channel improvements to reduce flood hazards at flood damage centers. Flood insurance may be considered for indemnifying flood losses not eliminated by the comprehensive plan.

II. *Purpose* — The purpose of these studies is to secure an appraisal of the potential needs and measures for flood control and prevention. These studies would include (1) initially a single-purpose solution with approximate economic justification, and (2) finally the development of an economically justified program to meet the needs.

III. *Scope* — The flood control and prevention studies are to be in sufficient detail to determine the economic and physical feasibility of the considered improvements and to be suitable for use in formulating the comprehensive plan through the years 1975 and 2000.

IV. Work Plan Outline

- A. Develop standards, definitions and criteria
- B. Technical Tasks
 - 1. Study of flood damages
 - a. Study of present flood damages and inventory of existing flood control projects by damage centers and river reaches using data supplemented by field survey.
 - b. Study of potential flood hazards based on field survey, the economic projections of universities under contract, and ultimate planned development and use of flood plains for years 1975 and 2000.
 - 2. Hydrologic and hydraulic studies of selected floods of record so that under present conditions flood hydrographs may be reproduced at any flood damage center in the river system. Study of flood frequency, stage-damage and damage-frequency relations.
 - 3. Studies of physical and economic effects of forest and soil conservation programs.
 - a. Studies to determine the physical and economic effect of programs for forest and soil conservation on flood damages.
 - b. Allocation of benefits and costs of forest and soil conservation programs to function of flood control and prevention.
 - 4. Study of damage reducing measures.
 - a. Studies to determine the physical and economic effects of damage reducing measures.
 - 1. Flood warning and forecasting system.
 - 2. Flood plain zoning.
 - 3. Floodway planning and regulation.
 - 4. Evacuation of flood plain.
 - 5. Levees.
 - 6. Channel improvements.
 - 7. Reservoirs.
 - b. Benefits and costs for providing separately each measure.
- C. Technical Assignments

- 1. Possible cooperating agencies listed by staff.

Subject	Agencies
IV-B-1 Flood damages	C/E, USDA
a. Present	C/E, USDA,
b. Future	HHFA, States, Colleges

Subject	Agencies
IV-B-2 Hydrologic-hydraulic studies	C/E, USDA, USGS, USWB
IV-B-3 Forest & Soil Conservation	USDA, States
IV-B-4 Study of damage reducing measures	
a-1 Flood forecasting	USWB
a-2 Flood zoning	C/E, States, Colleges
a-3 Floodway planning	C/E, States
a-4 Evacuation	
a-5 Levees	C/E, USDA, States
a-6 Channel improvements	C/E, USDA, States
a-7 Reservoirs	C/E, USDA, States
b Benefits & Costs	C/E, USDA, USWB, States

- 2. Recommendations of Water Work Group on possible assignments and timing.
- 3. Commission staff arrangements for technical assignments.
 - a. Development memorandum of understanding with assignee for task to be done.
 - b. Date for beginning work.
 - c. Completion date.

V. Preparation of *Technical Memoranda* for the Commission on assigned task and transmitted to Water Work Group by Commission Staff.

VI. Preparation of individual *Basin Functional Memoranda* by Sub-Work Group.

- A. Single-purpose plan for function of flood control and prevention.
- B. Suggestions for modifying the single-purpose plan of flood control and prevention so that it can be integrated with plan for other purposes.

VII. Preparation of material for draft report by Commission Staff.

SECTION VI - WATER SUPPLIES

General Concept

The water supply studies embrace future water supply needs based on extrapolation of recent and current practices and requirements, tempered by technical judgment to allow for expected trends and special conditions. Data regarding the present water supplies are essential to determine present needs, to project future needs for rural, municipal, and industrial water uses, and to evaluate effects of future water use on the water resource.

Plans for meeting the projected water supply needs for 1975 and 2000 are based on the single-purpose analysis but, when appropriate, are co-ordinated into multiple-purpose plans. Water supplies are defined as: (1) Domestic water supplies, those serving rural domestic needs; (2) municipal water supplies, those serving communities of 50 or more houses providing water for domestic, commercial, and some industrial use; and (3) industrial water supplies, those owned and operated by industry.

Water supplies should be chemically and bacteriologically safe from a health standpoint and adequate in quantity to meet domestic, commercial, industrial, and fire underwriter's requirements. Information on water quality obtained from the water supply study is used in evaluation of the water resources. The water supply study is closely allied to the water pollution control study since waste and sewage discharged upstream may affect water-oriented uses or be reused as a downstream water supply. Maintaining suitable stream water quality is important for all water uses.

The costs of providing adequate supplies should be developed by orderly planning. Cost estimates for plants should be based on the anticipated growth within the life of the structure and the available plant capacity must equal or exceed the estimated maximum demand. Adequate water supply capacity encourages increased economic development.

Costs and benefits are considered in choosing between alternate plans for meeting future requirements. Each supply is considered on a case-by-case basis. In general, estimates of cost for the Coastal Plain are based on the develop-

ment of ground water sources which are abundant, of good quality, and can be developed economically. The water supply studies cover water source, treatment requirements, and distribution systems with consideration of management and administrative phases including both financing and regulation. The development of combined water systems is encouraged as opposed to a number of smaller systems serving smaller groups or individuals.

The Commission studies are not intended to take the place of detailed studies expected of consulting engineers engaged in planning specific water supplies but rather to establish guiding principles setting forth as specifically as possible the cost of present and future water needs and to present suggestions on how to meet the needs.

Work Plan

Work plans for domestic, municipal, and industrial water supply studies were prepared and were verified by a committee on domestic, municipal, and industrial water supply composed of members from the Alabama Water Improvement Commission, the Florida State Board of Health, the Georgia Department of Public Health, the U. S. Geological Survey, the U. S. Public Health Service, and staff members of the U. S. Study Commission.

The committee reviewed the work plans, discussed problems involving collection inventories, making projections, and estimating future requirements, and set benchmarks and guidelines for development of work agreements to implement the work. Considering recommendations of the committee, the work plan was firmed up and a set of proposals developed for doing the work. The work was primarily allocated to the States to gather and organize the data and to the U. S. Public Health Service to make the analysis. In regard to municipal water supply, an important objective was to pinpoint communities expecting to have acute need for future water supply. In regard to industrial water supplies, the important objective was to establish guidelines for location of future industries where waste discharges will not create problems for downstream water uses.

Work Performance

Basic information on water supplies of the Southeast River Basins area is available in the files of the State departments of health. Field investigations were made to obtain inventory data necessary for updating and supplementing this existing information and establishing the adequacy of existing water facilities. A limited sampling of the rural domestic supplies was made. All municipalities and most of the larger industries were inventoried in accordance with instructions included at the end of this Section.

Using the Economic Framework developed by the Commission staff, an estimate of urban and rural populations by basins and by place for the years 1975 and 2000 was established. Present rural domestic and municipal water use was estimated using 1960 census figures and inventory data for population served by municipal systems. The establishment of ratios of urban to rural population with an assumption as to the development of densely populated rural areas of the future which could be better served by community systems are necessary in planning future water supply facility requirements. Where the quality of the available water varied from desirable standards, facilities for treatment are included in the plan. Criteria establishing water quality requirements for various uses were compiled. A copy is included in the supplementary data of this Section. Cost information on recently installed systems was obtained. The appropriate unit value applied to estimated population to be served by new or enlarged facilities gave a dollar value for the meeting of needs. Costs of existing facilities of adequate capacity to meet present and future needs are not included.

Contracts were made with the Florida State Board of Health and the Alabama Water Improvement Commission for the collecting, summarizing, and reporting of basic data on domestic, municipal, and industrial water supplies and water quality. These contracts also included provisions for the collection of data on water pollution, insect vector control, air pollution, radiation monitoring, and garbage disposal. The work was performed by the contractor in accordance with instructions which are included as supplemental data in this Section.

Data for the South Carolina portion of the basins were collected by the U. S. Public Health

Service from the central files of the State. The U. S. Public Health Service collected data and made field inventories to supplement the available Georgia data. Three engineers and one stenographer were loaned to the Georgia Department of Public Health for the purpose of obtaining the necessary data. A special office designated as the Water Resources Survey was established by the Georgia Department of Public Health for the purposes of inventorying all of the municipal water supplies and all of the major industrial water users throughout the State. A very limited sample was also collected of water uses from farm and rural wells. These data, collected as a State function, were transmitted to the U. S. Public Health Service and used in the development of a technical memorandum for the river basins.

A work agreement was made with the U. S. Public Health Service to assimilate and compile data into technical memoranda. A copy of the "Work Plan Covering Terminal Studies for Comprehensive Resource Development and Utilization in the Southeast River Basins" is included as supplementary data in this Section.

Coordination

The activities of the State health departments and the U. S. Public Health Service in the collection, summarizing, and reporting of the data were coordinated by the Commission. Direct informal liaison between the agencies, State and Federal, doing the work was encouraged on a continuing basis. Also, the Committee on Water Supplies, Pollution Abatement, and Public Health, which was mentioned in the discussion of work plans, served as a more formal coordination device. The Land, Water, and Economics Groups also served as a means of coordinating the water supply studies. In the main, the effort in coordination of the Commission studies on water supplies was accomplished by informal discussions and liaison with the working agencies by the Commission staff specialist.

Findings

Under the work plan agreements, the U. S. Public Health Service developed a technical memorandum for water supply, pollution abatement, and public health for each of the eight river basins of the Southeast River Basins area.

These memoranda included a listing of existing water supplies with an appraisal of their adequacy based on present use and estimated future domestic, municipal, and industrial water supply

needs adjusted to the Economic Framework population projections set forth in Appendix 9, Part Three, and to the expected industrial development.

TABLE 2.6
Water Use - 1960

Basin	Rural				Municipal		Industrial ²			
	Domestic Use ¹	Per- cent	Livestock Use ¹	Per- cent	Irrigation 1,000 acre Per- ft./yr. cent	Use ¹	Per- cent	Use ¹	Per- cent	
Savannah	12.2	4.0	7.6	2.4	12.8	3.6	50.3	16.2	229.4	73.8
Ogeechee	4.9	19.0	2.1	9.0	7.2	27.0	10.4	43.0	0.6	2.0
Altamaha	17.0	9.4	12.3	6.9	16.0	8.1	41.9	23.3	93.8	52.3
Satilla-St. Marys	3.2	1.8	3.1	1.7	9.3	3.8	10.1	5.5	160.0	87.2
Suwannee	5.9	7.3	7.6	9.4	26.0	28.8	16.5	20.5	27.3	34.0
Ochlockonee	4.2	6.0	3.3	4.8	6.2	8.0	11.3	16.3	45.0	64.9
A-C-F	14.2	5.3	16.8	6.2	18.2	6.0	163.5	60.5	59.4	22.0
Choctawhatchee-Perdido	14.4	4.6	10.0	3.2	2.4	0.7	43.5	13.9	242.0	77.6
Total percent	76.0	4.8	62.8	4.0	98.1	5.5	347.6	24.7	857.5	61.0

NOTES: ¹ Million gallons per day.

² Includes water supplied by municipal systems.

³ Includes water supplied to Altamaha basin.

TABLE 2.7
Estimated Water Facilities Needs¹

Year	Number of supplies	Rural domestic water supplies Needs by number of supplies			Population served
		New wells	Improvements	Rehabilitation	
1960	334,200				1,521,300
1975	294,000	48,100	162,800		1,322,200
2000	205,700			205,700	924,400
Municipal water supplies ² Needs by numbers of supplies					
		New source or treatment	Elevated storage	Distribution system	
1960	607				3,426,800
1975	546	379	292	447	5,085,300
2000	607	230	205	490	9,128,800
Industrial water supplies					
	Number of industries with separate supplies ³	Enlargements or new supplies needed			
1960	331				
1975	353			84	
2000	355			105	

NOTES: ¹ 1975 and 2000 values are terminal for the 1960-75 and 1975-2000 periods, respectively. Impoundments needed as of 1960 are included in the 1975 figures.

² Includes Federal installations, State institutions, and subdivisions with separate systems. Consolidation of urban supplies and the development of countywide systems is planned, reducing the number of supplies in 1975.

³ A number of industries obtain water from municipal systems. It is anticipated that additional industries will depend on municipal or countywide water systems for their water needs. Some new industries will develop supplies or provide treatment to meet special process water requirements.

In developing a means of meeting the needs the choice between ground water sources and surface sources was made on the basis of the availability of water and the costs involved. Where ground water sources were known to be highly mineralized or where the development of additional wells with large localized withdrawals might create problems of salt-water encroachment, surface water supplies were selected.

Throughout the major portion of the study area, the development of ground water supplies will still remain the most economical means of meeting the water needs. The municipal water facility needs were developed as outlined in "Criteria for Planning to Meet Future Municipal Water and Sewerage Needs," which is included as supplemental data in this Section.

TABLE 2.8
Domestic Water Facilities*

Basin	Year	Population (1,000)	Number of wells (1,000)	Needs (number)		
				New wells	Improve- ments	Rehabili- tation
Savannah	1960	243.5	54.0			
	1975	193.2	43.0	10,000	27,000	
	2000	147.8	33.0			33,000
Ogeechee	1960	98.8	21.9			
	1975	66.0	14.7	2,200	3,800	
	2000	30.7	6.8			6,800
Altamaha	1960	340.6	76.0			
	1975	283.0	63.0	5,200	48,000	
	2000	138.5	31.0			31,000
Satilla-St. Marys	1960	64.2	14.3			
	1975	60.1	13.4	1,300	9,300	
	2000	44.2	9.8			9,800
Suwannee	1960	118.8	26.4			
	1975	127.7	28.4	3,200	16,700	
	2000	56.8	12.6			12,600
Ochlockonee	1960	84.1	18.6			
	1975	84.7	18.7	600	12,000	
	2000	50.0	11.1			11,100
A-C-F	1960	284.0	63.0			
	1975	256.4	57.0	22,000	16,000	
	2000	229.5	51.0			51,000
Choctawhatchee-Perdido	1960	287.3	60.0			
	1975	251.1	55.8	3,600	30,000	
	2000	226.9	50.4			50,400
Total	1960	1,521.3	334.2			
	1975	1,322.2	294.0	48,100	162,800	
	2000	924.4	205.7			205,700

* Values for 1975 and 2000 are terminal for the 1960-75 and 1975-2000 periods, respectively. Improvements needed as of 1960 are included in the 1975 figures.

TABLE 2.9
Municipal and Industrial Water Facilities¹

Basin	Year	Population served (1,000)	Number of systems ²	New source and/or treatment	Elevated tank	Distribution system	Number of separate industrial supplies
Savannah	1960	488.2	(23) 106				120
	1975	746.6	88	61	32	64	123
	2000	1,306.2	97	35	22	72	125
Ogeechee	1960	102.7	(2) 27				8
	1975	146.8	(2) 27	18	21	27	12
	2000	237.0	(2) 27	12	6	27	12
Altamaha	1960	699.9	(4) 103				36
	1975	1,006.1	(4) 90	72	47	77	36
	2000	1,646.2	(4) 91	23	20	79	36
Satilla-St. Marys	1960	101.3	(2) 28				41
	1975	149.1	(2) 27	18	22	24	41
	2000	273.0	(2) 29	8	10	25	41
Suwannee	1960	168.4	(3) 60				28
	1975	210.7	(3) 63	42	43	56	32
	2000	350.9	(3) 72	24	31	68	32
Ochlockonee	1960	123.7	(3) 31				17
	1975	174.0	(3) 33	19	20	25	26
	2000	297.9	(3) *31	4	6	27	26
A-C-F	1960	1,337.4	(13) 151				52
	1975	1,988.0	(7) *134	90	52	95	54
Choctawhatchee-Perdido	2000	3,726.8	(7) 137	60	45	87	54
	1960	405.2	(10) 100				*29
	1975	664.0	(10) 104	59	55	79	29
Total	2000	1,290.8	(10) 124	64	65	105	29
	1960	3,426.8	(60) 606				331
	1975	5,085.3	(31) 566	379	292	447	353
	2000	9,128.8	(31) 606	230	205	490	355

NOTES: ¹ Values for 1975 and 2000 are terminal for the 1960-75 and 1975-2000 periods, respectively. Improvements needed as of 1960 are included in the 1975 figures.

² Federal installations, State institutions and subdivisions shown by numbers in parentheses are included in total. Subdivisions are included as part of municipal system serving the total urban area after 1960.

³ Includes population served by supplies with sources outside of basin.

⁴ Three towns dropped after 1975.

⁵ Seven dropped in Georgia, one added in Florida, some are combined.

⁶ One system supplies three industries.

TABLE 2.10
Water Facilities Costs—2000
 (thousands of dollars) |

Basin and type of supply	Costs				
	Investment	OM&R at year 2000		Annual equivalent	
			Investment	OM&R	Total
Savannah					
Domestic	23,400.0	408.3	702.0	167.8	869.8
Georgia	(12,600.0)	(220.5)	(379.1)	(90.6)	(469.7)
South Carolina	(10,300.0)	(179.6)	(308.9)	(73.8)	(382.7)
North Carolina	(500.0)	(8.2)	(14.0)	(3.4)	(17.4)
Municipal	88,476.0	9,628.6	1,868.0	5,040.0	6,908.0
Georgia	(64,843.0)	(7,342.9)	(1,339.0)	(3,706.0)	(5,045.0)
South Carolina	(23,633.0)	(2,285.7)	(529.0)	(1,334.0)	(1,863.0)
Industrial	10,221.0	1,217.9	242.4	949.0	1,191.4
Georgia	(10,173.0)	(1,211.9)	(241.4)	(948.3)	(1,189.7)
South Carolina	(48.0)	(6.0)	(1.0)	(0.7)	(1.7)
Total	122,097.0	11,254.8	2,812.4	6,156.8	8,969.2
Georgia	(87,616.0)	(8,775.3)	(1,959.5)	(4,744.9)	(6,704.4)
South Carolina	(33,981.0)	(2,471.3)	(838.9)	(1,408.5)	(2,247.4)
North Carolina	(500.0)	(8.2)	(14.0)	(3.4)	(17.4)
Ogeechee					
Domestic	4,800.0	80.1	144.0	30.7	174.7
Municipal	11,887.9	1,640.5	277.2	893.8	1,171.0
Industrial	84.0	92.2	2.2	62.0	64.2
Total	16,771.9	1,812.8	423.4	986.5	1,409.9
Altamaha					
Domestic	19,640.0	405.7	589.2	210.4	799.6
Municipal	35,452.0	4,567.4	793.7	2,437.2	3,230.9
Industrial	9,061.0	1,416.2	196.3	828.6	1,024.9
Total	64,153.0	6,389.3	1,579.2	3,476.2	5,055.4
Satilla-St. Marys					
Domestic	3,940.0	118.1	118.2	47.4	165.6
Georgia	(3,664.0)	(109.8)	(109.9)	(44.1)	(154.0)
Florida	(276.0)	(8.3)	(8.3)	(3.3)	(11.6)
Municipal	16,474.0	2,038.8	383.0	1,096.7	1,479.7
Georgia	(15,021.0)	(1,796.4)	(345.4)	(963.0)	(1,308.4)
Florida	(1,453.0)	(242.4)	(37.6)	(133.7)	(171.3)
Industrial	2,088.0	2,477.6	171.9	1,447.4	1,619.3
Georgia	(1,416.0)	(1,692.1)	(157.1)	(1,030.9)	(1,188.0)
Florida	(672.0)	(785.5)	(14.8)	(416.5)	(431.3)
Total	22,502.0	4,634.5	673.1	2,591.5	3,264.6
Georgia	(20,101.0)	(3,598.3)	(612.4)	(2,038.0)	(2,650.4)
Florida	(2,401.0)	(1,036.2)	(60.7)	(553.5)	(614.2)

(continued)

TABLE 2.10—Continued

Basin and type of supply	Costs				
	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Suwannee					
Domestic	6,811.0	126.3	204.3	66.0	270.3
Florida	(2,384.0)	(44.2)	(71.6)	(23.0)	(94.6)
Georgia	(4,427.0)	(82.1)	(132.7)	(43.0)	(175.7)
Municipal	15,111.0	1,442.3	341.8	720.3	1,062.1
Florida	(4,533.0)	(432.7)	(102.5)	(216.1)	(318.6)
Georgia	(10,578.0)	(1,009.6)	(239.3)	(504.2)	(743.5)
Industrial	520.0	686.1	12.1	351.9	364.0
Florida	(312.0)	(411.7)	(7.3)	(211.1)	(218.4)
Georgia	(208.0)	(274.4)	(4.8)	(140.8)	(145.6)
Total	22,442.0	2,254.7	558.2	1,138.2	1,696.4
Florida	(7,229.0)	(888.6)	(181.4)	(450.2)	(631.6)
Georgia	(15,213.0)	(1,366.1)	(376.8)	(688.0)	(1,064.8)
Ochlockonee					
Domestic	3,090.0	137.7	92.7	62.0	154.7
Florida	(1,297.8)	(57.8)	(39.0)	(26.0)	(65.0)
Georgia	(1,792.2)	(79.9)	(53.7)	(36.0)	(89.7)
Municipal	18,062.0	1,439.5	415.0	816.5	1,231.5
Florida	(12,983.0)	(1,080.8)	(291.3)	(612.0)	(903.3)
Georgia	(5,079.0)	(358.7)	(123.7)	(204.5)	(328.2)
Industrial	6,048.5	1,626.5	146.8	927.5	1,074.3
Florida	(5,623.0)	(622.0)	(136.0)	(380.9)	(516.9)
Georgia	(425.5)	(1,004.5)	(10.8)	(546.6)	(557.4)
Total	27,200.5	3,203.7	654.5	1,806.0	2,460.5
Florida	(19,903.8)	(1,760.6)	(466.3)	(1,018.9)	(1,485.2)
Georgia	(7,296.7)	(1,443.1)	(188.2)	(787.1)	(975.3)
Apalachicola-Chattahoochee-Flint					
Domestic	38,800.0	599.6	1,164.0	240.4	1,404.4
Alabama	(4,600.0)	(71.8)	(138.0)	(29.7)	(167.7)
Florida	(2,300.0)	(31.7)	(69.0)	(13.3)	(82.3)
Georgia	(31,900.0)	(496.1)	(957.0)	(197.0)	(1,154.4)
Municipal	322,773.0	32,457.5	6,858.5	16,884.4	23,742.9
Alabama	(15,852.0)	(1,761.0)	(394.0)	(1,034.0)	(1,428.0)
Florida	(3,639.0)	(392.2)	(84.4)	(203.3)	(287.7)
Georgia	(303,282.0)	(33,304.3)	(6,380.1)	(15,647.1)	(22,027.2)
Industrial	1,039.0	478.0	27.6	323.5	351.1
Alabama	--	--	--	--	--
Florida	(91.0)	(37.1)	(2.4)	(21.9)	(24.3)
Georgia	(948.0)	(440.9)	(25.2)	(301.6)	(326.8)
Total	362,612.0	33,535.1	8,050.1	17,448.3	25,498.4
Alabama	(20,452.0)	(1,832.8)	(532.0)	(1,063.7)	(1,595.7)
Florida	(6,030.0)	(461.0)	(155.8)	(238.5)	(394.3)
Georgia	(336,130.0)	(31,241.3)	(7,362.3)	(16,146.1)	(23,508.4)

(continued)

TABLE 2.10—Continued

Basin and type of supply	Costs					
	Investment	OM&R at year 2000	Annual equivalent			
			Investment	OM&R	Total	
Choctawhatchee-Perdido						
Domestic	9,900.0	473.1	297.0	172.2	469.2	
Alabama	(3,366.0)	(160.9)	(101.0)	(58.5)	(159.5)	
Florida	(6,534.0)	(312.2)	(196.0)	(113.7)	(309.7)	
Municipal	82,414.0	10,068.4	1,796.1	5,371.7	7,167.8	
Alabama	(13,400.0)	(1,919.2)	(310.5)	(1,108.6)	(1,419.1)	
Florida	(69,014.0)	(8,149.2)	(1,485.6)	(4,263.1)	(5,748.7)	
Industrial	26,443.5	7,728.4	567.9	4,136.9	4,704.8	
Alabama	(9,769.5)	(1,449.4)	(201.9)	(789.8)	(991.7)	
Florida	(16,674.0)	(6,279.0)	(366.0)	(3,347.1)	(3,713.1)	
Total	118,757.5	18,269.9	2,661.0	9,680.8	12,341.8	
Alabama	(26,535.5)	(3,529.5)	(613.4)	(1,956.9)	(2,570.3)	
Florida	(92,222.0)	(14,740.4)	(2,047.6)	(7,723.9)	(9,771.5)	
Study Area						
Domestic	110,381.0	2,348.9	3,311.4	996.9	4,308.3	
Alabama	(7,966.0)	(232.7)	(239.0)	(88.2)	(327.2)	
Florida	(12,791.8)	(454.2)	(383.9)	(179.3)	(563.2)	
Georgia	(78,823.2)	(1,474.2)	(2,365.6)	(652.2)	(3,017.8)	
South Carolina	(10,300.0)	(179.6)	(308.9)	(73.8)	(382.7)	
North Carolina	(500.0)	(8.2)	(14.0)	(3.4)	(17.4)	
Municipal	590,649.9	63,283.0	12,733.3	33,260.6	45,993.9	
Alabama	(29,252.0)	(3,680.2)	(704.5)	(2,142.6)	(2,847.1)	
Florida	(91,622.0)	(10,297.3)	(2,001.4)	(5,428.2)	(7,429.6)	
Georgia	(446,142.9)	(47,019.8)	(9,498.4)	(24,355.8)	(33,854.2)	
South Carolina	(23,633.0)	(2,285.7)	(529.0)	(1,334.0)	(1,863.0)	
North Carolina	--	--	--	--	--	
Industrial	55,505.0	15,722.9	1,367.2	9,026.8	10,394.0	
Alabama	(9,769.5)	(1,449.4)	(201.9)	(789.8)	(991.7)	
Florida	(23,372.0)	(8,135.3)	(526.5)	(4,377.5)	(4,904.0)	
Georgia	(22,315.5)	(6,132.2)	(637.8)	(3,858.8)	(4,496.6)	
South Carolina	(48.0)	(6.0)	(1.0)	(0.7)	(1.7)	
North Carolina	--	--	--	--	--	
Total	756,535.9	81,354.8	17,429.9	43,284.3	60,696.2	
Alabama	(46,987.5)	(5,362.3)	(1,145.4)	(3,020.6)	(4,166.0)	
Florida	(127,785.8)	(18,886.8)	(2,929.8)	(9,985.0)	(12,896.8)	
Georgia	(547,281.6)	(54,626.2)	(12,501.8)	(28,866.8)	(41,368.6)	
South Carolina	(33,981.0)	(2,471.3)	(838.9)	(1,408.5)	(2,247.4)	
North Carolina	(500.0)	(8.2)	(14.0)	(3.4)	(17.4)	

Comprehensive Plan

Most of the water supplies have been developed as single-purpose projects because of the nature of the needs. When required, treatment has been provided to improve the quality of the water. In all cases, the protection of the source and the treatment of the water in the interest of the public health, safety, and welfare has been a prime consideration. Benefits for water supplies are considered at least equal to the cost of providing a safe adequate water sup-

ply from the most likely alternative sources.

In the development of multiple-purpose reservoirs, consideration was given to possible need for storage designated for water supply purposes. The storage required to assure an adequate water supply was found to be small compared with storages for other purposes. However, whenever the development of the surface water supply was desirable, storage was assigned for this purpose on equal status with storage for other water uses in the comprehensive plan.

Bibliography

U. S. Department of Health, Education, and Welfare, Public Health Service, Region IV, Water Supply and Pollution Control Program, Atlanta, Georgia. *Technical Memoranda for Water Supplies, Pollution Abatement and Public Health*. Arrays of data provided by States compiled by Public Health Service with development of single-purpose needs fitted to population projection by line item.

Savannah Basin — January 1962

Ogeechee Basin — November 1960

Altamaha Basin — May 1962

Satilla-St. Marys-Nassau Basins — December 1960

Suwannee Basin — December 1960

Ochlockonee Basin — May 1961

Apalachicola-Chattahoochee-Flint Basins — March 1962

Choctawhatchee-Perdido Basins — August 1961

U. S. Department of Health, Education, and Welfare, Public Health Service, Region IV, 1961. *Water Quality Basic Data Southeast River Basins*, Compilation of available water quality data supplemented by data obtained in a limited stream study.

Callahan, Joseph T. *The Yield of Sedimentary Aquifers of the Coastal Plain, Southeast River Basins*, Water Resources Division, U. S. Geological Survey, Atlanta, Georgia, 1961. A study of estimated "safe yield" of sedimentary aquifers of the coastal plains.

Florida Water Resources Study Commission. *Florida's Water Resources*, December 1956. A study of the physical, administrative, and legal aspects of water problems and water management. A report to the Governor of Florida and the 1957 Legislature.

Florida Department of Water Resources. *Second Biennial Report, 1959-1960*. An accounting of Florida's water resources.

Florida State Board of Conservation, Division of Water Survey and Research. *Chemical Character of Florida's Waters — 1951*. Tabulated chemical analysis with brief summaries on topography, geology, and water quality.

U. S. Geological Survey. *Chemical Quality of Water in Georgia Streams, 1957-58*, Bulletin No. 69. A reconnaissance study.

State Division of Conservation. *The Availability and Use of Water in Georgia*, Bulletin No. 65, Department of Mines, Mining and Geology, Atlanta, Georgia, 1956. Summary of existing information on the water resources of Georgia with an appraisal of availability, chemical quality, and present and future utilization.

State Water Pollution Control Board, Sacramento, California. *Water Quality Criteria*, Second Printing, 1957. Compendium of technical and legal literature pertaining to water quality criteria for various beneficial uses of water.

United States Congress, Senate. *Reports of Select Committee on National Water Resources, 1960*: Committee Print 7, Future Water Requirements for Municipal Use and Committee Print 8, Future Water Requirements of Principal Water Using Industries.

Supplemental Data

Selected documents referred to in the narrative on water supply studies follow. Other pertinent data on water supply studies are included in the files of the United States Study Commission, Southeast River Basins.

Selected Documents:

Instructions — Domestic Water Inventory

Instructions — Municipal Water Inventory, Surface and Ground

Instructions — Industrial Water and Waste Inventory

Criteria Establishing Raw (Untreated) Water Quality Requirements

Criteria for Planning to Meet the Future Municipal Water and Sewerage Needs

Work Plan Covering Terminal Studies for Water Supplies, Pollution Abatement and Public Health, by the U. S. Public Health Service — Department of Health, Education and Welfare.

WORKSHEET

DOMESTIC WATER INVENTORY¹

Introduction

This inventory sheet has been developed to collect part of the basic data needed in studying individual domestic water supplies. It will be used on a relatively small "sample" of supplies and calls for a minimum of information. All the information will be usable in the studies or in identifying the "sample."

It is believed that field interviewers, after completing their "samples" will have generalized impressions of domestic water supplies that do not show up on the inventory. Impressions regarding trends in availability, convenience, sanitation and desires of owners are examples. Also there may be important ideas and information not covered in the inventory that should be included in the study. Pictures of supplies and outstanding examples of success with domestic water supplies are welcome. It would be helpful if these impressions and information were set forth in the interviewers own words. Literary style is not important for what is sought is "grass roots" background impressions and information.

Identification

Definition — Domestic water supplies are those supplies used for individual families, including those also serving tenant families living on the property. Domestic supplies will not include commercial establishments, schools, churches, camps, etc.

Name — The name of the head of the family occupying the premises at time of survey.

Postal address — House, box, or R.F.D. number; street or rural route, and name of post office.

¹ Information obtained was placed on an inventory sheet in accordance with the listed items shown here.

Location — Name of nearest incorporated municipality and distance in miles, direction and name of road from that municipality.

Basin — U. S. Study Commission basin name.

Number of persons using supply — Total number of persons using supply — If more than one family uses supply place an asterisk after number of persons and under remarks give number of other families using supply and state if they are tenant families or families not living on the property.

State — Self-evident.

County — Self-evident.

Water Supply

Classification — Circle one that applies.

Farm — (a) *Places of 3 or more acres and producing \$150.00 or more of farm products for sale.*

(b) *Places of less than 3 acres if they produce \$250.00 or more of farm products for sale or home use.*

Rural Non-farm — Places not included under Farm and located in communities of less than 2500 population.

Source: Surface — If source is spring, stream or farm pond, circle proper word. If some other source is used, for instance cistern, write the type in line following "other." Well — Circle word which describes type of construction of well.

Depth — Total depth of well not the depth to water surface.

Treatment — If water is not treated, write "none." If water is treated, state type of treatment, such as filtration, settling, chlorination, etc.

Does supply meet Health Department Standards?

Source — If observation or available information shows that the source does or does not meet State Health Department standards, indicate by "yes" or "no." If no determination can be made, indicate with the word "undetermined."

Installation — "yes" or "no" as determined by observation at time of survey.

Undesirable water characteristics — Circle the word or words which best describe the water characteristics and write in any additional characteristics not among those listed.

Estimated volume used — Estimate the average volume of water used per day. Use owner's estimate if he knows, or pump capacity and time of operation, or the following table:

Domestic use per person	Normal gallons per day
Household having	
1 hand pump	10
1 pressure faucet at kitchen sink	15
Hot and cold running water—kitchen, laundry, and bath	50
Domestic use—livestock	
Per horse, mule or steer	12
Per dairy cow (drinking only)	15
Per dairy cow (drinking and servicing)	35
Per hog	4

Domestic use—livestock	Normal gallons per day
Per sheep	2
Per 100 chickens	6
Per 100 turkeys and ducks	20
Other uses	Gallons per hour
Water hose $\frac{5}{8}$ inch	200
Water hose $\frac{3}{4}$ inch	300

If use must be curtailed because of low water, give months-self explanatory. If water supply is inadequate explain — State if quantity, quality, or equipment is inadequate and why it is inadequate in opinion of user.

Water System

Type of pump — Write in type of pump or water moving device such as bucket, reciprocating, centrifugal, turbine, submersible, jet or rotary.

Running water in house — "Yes" or "no."

Bath and toilet facilities — "Yes" or "no."

WORK SHEET MUNICIPAL WATER SUPPLY INVENTORY¹ (Surface and Ground)

Introduction

This inventory has been developed with full recognition of the interviewer's importance in its successful use. A complete inventory is desired, but time is limited, and the interviewer should exercise judgment in searching out or computing information not readily available. Some gaps in information on specific municipalities are anticipated.

The inventory has been made as simple as possible and may have omitted significant items of local interest. Where such is the case, please describe under remarks, or if a matter concerning several municipalities, a separate narrative report is solicited. Annual reports and photographs are welcome as is incidental information on water resource needs. It is not intended, however, that special calls be made on planning commissions as this information will be collected from other sources.

Definitions

Municipal supply is a public supply serving a municipality or other government unit with 50 or more people.

Semi-public supplies are schools, motels, camps, and other supplies serving water to the public; or commercial establishments not classed as municipal or industrial.

Identifications

Basin — U. S. Study Commission basin name.

State — Self-explanatory.

County — Self-explanatory.

Municipality — Name of the municipal or semi-public unit as defined above.

¹ Information obtained was placed on an inventory sheet in accordance with the listed items shown here.

1960 Population — The 1960 census population for municipal supplies and the estimated population using the facility for semi-public supplies.

Official contacted — Name of person supplying information.

Title — Official title of person supplying information.

Population served:

Inside city limits — The number of persons residing within the city limits who are connected to the municipal water supply system.

Outside city limits — The number of persons residing in suburban outlying areas who are connected to the municipal water supply system. This will *not* include the number of persons residing in other municipalities which purchase water from the municipal water system.

Number of services — The total number of customers who are billed for water service.

Percent metered — Percent of services metered.

Ownership:

Public — Indicate by check mark if municipality owns and operates the water supply facilities.

Private — Name of private individual, company, or corporation who supplies water to the municipality.

Source (Surface Water Inventory)

Enter name of lake, stream river, reservoir, spring, or other above ground source of supply.

Safe Yield — The maximum permissible rate of MGD at which water can be obtained from the source as determined by past experience.

Demand — The average rate in MGD at which water has been obtained by user in the past year.

Does source meet State Health Department quality standards — "yes" or "no."

If not, explain. — Explain what characteristics of the source are not acceptable and the cause(s) of those characteristics being present, e.g., a source receiving waste discharges.

Water Characteristics — Circle items which are appropriate and/or write in other item not listed.

Possible Alternate Source — Name other sources which in the opinion of the person being interviewed or the interviewer could be used as an alternate source of water for the public or semi-public unit being considered. The use of other municipal supplies especially for semi-public units should be considered as an alternate source.

Source (Ground Water Inventory)

Number and type of wells — List the types of wells being used giving the number of each type, e.g., 2 dug, 3 drilled, etc.

Supply meets State Health Department standards — Indicate by "yes" or "no" whether the quality of the ground water and the type and construction of the installation meet State Health Department standards. If "no," explain on reverse side what features do not meet the standards and the causes of these unacceptable features.

Depth — List the various depths at which water is obtained. If several wells obtain water from the same depth, only list that particular depth once.

Type of pump and rated capacity — List types of pumps being used (air lift, centrifugal, reciprocating, etc.) and their capacities as rated by the manufacturers.

Maximum sustained yield — The maximum combined withdrawal rate which can be maintained from each of the types of wells, i.e., 100 GPM from the dug wells, 150 GPM from the drilled wells, etc.

Treatment

Principal features of treatment — Use the code symbols given in the PHS "Inventory of Municipal Water Facilities."

Difficult treatment problems — Mention any problem which has been encountered in the treatment of water resulting from its quality, e.g., taste and odor problems, "red" water, etc.

Date of construction — The date on which the last *major* improvement to the plant was made.

Designed capacity — Smallest hydraulic capacity in MGD for any unit listed in "Principal Features of Treatment" above.

Laboratory control — Check appropriate item(s).

Does finished water meet State Health Department standards at all times — "yes" or "no."

If not, explain — Give reasons for unacceptability.

Plant output — Refers to amount of water pumped to distribution system.

Months of maximum demand — Give names of months.

Maximum month — The month in which the most water is used.

Treatment cost per MG — This item should include costs of power, chemicals, labor, maintenance and operation. In the smaller facilities this figure may not be readily available and, if estimated, indicate by writing "E" next to amount.

Distribution

Rated capacity of high service pumps — List the number and capacities of the pumps as rated by the manufacturer.

Storage on distribution system — The amount of finished water which is immediately available for distribution to the system. Include storage in clear well, but not in back wash tank or distribution lines.

Estimated percentage of water used by industry — Include all industrial water users. Exclude commercial users such as gas stations, stores, groceries, laundries, etc.

Estimated percentage of water lost through leakage — If not available, may be computed by difference between water used and water pumped.

Names of other municipalities purchasing water — Include those municipalities which purchase water and redistribute it through their own water system. Do not include those outlying areas which are served directly by the water supply system. Quantity to be reported as 12 month average.

Present Needs

Are additions or improvements needed — Include needs for source, treatment, and distribution. If yes, on line after appropriate item, indicate what is needed and give

estimated cost for the improvement and the date of estimate. See example below:

Additional supply 10 MGD — \$100,000 — 1959
Transmission 2 mi. 12" pipe — \$50,000 — 1959
Pumping — high lift service pump — \$10,000 — 1959
Treatment plant — 2 chlorinators — \$10,000 — 1954
1 clarifier — \$36,000 — 1954
Distribution — 6 miles — 8" pipe — \$75,000 — 1960
Storage — 1 — 5 MG elevated tank — \$50,000 — 1959

Financing

How will needs be financed — general obligation bonds, revenue bonds, bank loans, cash, etc.

Source of operating revenue — general taxation, water revenues, etc.

Is revenue adequate — refers to current revenue in all cases.

If no, give some idea of degree of inadequacy under remarks.

WORKSHEET INDUSTRIAL WATER AND WASTE INVENTORY¹

Introduction

Industrial water use and industrial waste are major considerations in planning studies. Without this basic information planning cannot proceed. The inventory contains the minimum information needed and consists of facts generally known to informed people in industry. Information in the inventory will be summarized so a particular industry cannot be identified in the final report of studies. If planning studies later indicate a need for deviation from this general rule, concurrence of the State pollution control agency will be obtained before deviation.

Identifications

Basin — U. S. Study Commission basin name.

State — Self-evident.

County — Self-evident.

Industry — Name under which industry does business.

Type — Write out type of industry using waste classification group designation as given in "Inventory Municipal and Industrial Waste Facilities; notes regarding tabulations, appendix A."

Informant — Name of person interviewed.

Title — Official title of person interviewed.

Mailing address — Post office address of the industry.

Descriptive location — Describe the location of industry so a person not familiar with the plant can find it. Give the name of the nearest municipality, the distance in miles and direction plant is from the municipality and the name and route of the road leading to the plant.

Product — Give the major product or products made.

Normal production — State the amount of products made or processed per day and the units used to measure production. Example: tons of pulp and paper produced; number of cattle killed; pounds of milk processed; size and number of cases of canned goods processed; pounds of cotton processed; yards of goods woven, finished, dyed, printed; etc.

Plant Operation

Hours per week — The average and maximum hours per week that the plant operates.

Weeks per year — The average and maximum number of weeks per year that the plant operates.

Number of employees — The average and maximum number of employees on all shifts.

Seasonal Variations — State if plant has a seasonal operation such as a cannery which might operate only three or four months or if the plant has certain periods of the year when work slacks off or increases considerably over average operations. Name the months when the seasonal operation or change occurs.

Planned expansion, change in process, etc. — Indicate any expansion, process or operation changes, etc., that are planned which will make a major change in the amount and quality of water needed or the amount and type of waste discharged.

Water Supply

Source — Write in the name of the lake, reservoir, stream, etc., if it is a surface source. If it is an underground source indicate by "well," "2 wells," "3 wells," etc.

Treatment — List the treatment units in accordance with PHS treatment code as used in the "Inventory of Municipal Water Facilities."

Work Season or 12 months average MGD — Give the 12 month average water use in million gallons per day if *industry operates 12 months per year*. If it is a seasonal industry give the average water used in million gallons per day for the last complete work season.

Maximum MGD of Record — Give the amount of water used during the day of maximum demand during the 12 month period or last complete work season used for computing the average water use.

Problems (describe) — Describe any problems that the plant encounters due to deficiencies in source, water quality, treatment facilities, etc.

Possible alternate supply — Indicate where industry might get additional water if needed. If surface, give name of lake, stream, or reservoir and approximate distance from plant.

Raw water characteristics — List the principal characteristics of raw water used.

Analyses available — Where analyses are available record frequency. For example: daily, monthly, etc.

Sanitary and Industrial Wastes

Total volume — Give the total volume of all wastes discharged by the industry and state how this volume was estimated such as measured, estimated from water use, etc.

PE (BOD)² untreated — Give the 5 day 20°C BOD population equivalent of the total waste before treatment and state how the value was estimated.

Type of waste — Indicate whether waste is organic, inorganic or both by circling the proper word or words.

¹ Information obtained was placed on an inventory sheet in accordance with the listed items shown here.

² Total daily weight of BOD of system = strength of sewage (BOD in ppm) × flow (MGD) × 8.34 lbs.

Waste characteristics — Such as acid, alkaline, inert solids, oily, metals, toxic, etc. Circle descriptive word(s) and write in other characteristics.

Treatment

Volume, and type of waste — give the volume of waste discharged from each outfall and the type of the waste such as sanitary, process, cooling water, etc.

Processes — If no treatment is given, indicate by word "none." If waste is treated give the processes employed using the treatment code given in PHS "Inventory of Municipal and Industrial Waste Facilities."

Period of Discharge — Indicate if discharge is continuous, one hour a day, 2 hours a day, one day a week, etc.

% Reduction: State the percent reduction obtained by treatment in P.E. (BOD), solids, and other characteristics of the waste such as acid, toxic materials, etc. Name the other characteristics of the waste such as acid, toxic materials, etc. Name the other characteristics reported on.

Needs — List treatment needs as enlargement, additions, new plant, replacement of plant, improved operation, connection to municipal system or none.

Receiving Stream

Describe the color, odor, turbidity, deposits, scum and other physical appearances of the stream below each outfall on day of plant visit.

Other Wastes Affecting Water Quality

Kind — List kinds of waste not listed above that may reach surface and underground water. These could be liquids and solids from trash dumps, lagoons, fly ash pits, oil sumps, etc.

Amount — Estimate amount of material reaching water.

Disposition — Describe method of disposing of waste and deficiencies in the disposal method that permit wastes to reach basins water.

Effect — Describe the effect of this waste on water quality.

CRITERIA ESTABLISHING RAW (UNTREATED) WATER QUALITY REQUIREMENTS

Introduction

The development and utilization of available water resources require consideration of the water quality with respect to the minimum acceptable raw water quality requirements for specific uses. The establishment of water quality guidelines is required for consistent resources planning. Such guidelines should be readily understood by non-technical workers and generally acceptable to experts in the field. These raw water quality requirements for specific water use were prepared for planning purposes in the Southeast River Basins Study Area.

Discussion

The value of water resources is limited by their usability (quality) as well as quantity. Since water is a universal diluent, chemically pure water is rarely found in nature. The concentrations of both man-made and natural im-

purities tend to increase although any body of water has some natural organic waste-assimilating capacity.

All water users would prefer a high-quality pristine pure water, but with competition for our water resources, such sources are not available to everyone. It is therefore expedient to protect our water resources by maintaining the highest economically feasible quality in our stream thus assuring water suitable for reuse.

Not all water uses require the same quality water. Quality characteristics desirable for one use may be less desirable for another. For example, laundries prefer a soft water low in calcium and magnesium salts, while bakeries need some calcium salts for proper fermentation, yet both will use the same water when there are no alternates.

Knowledge of the effects of water use on water quality, while extensive, is by no means complete. Our expanding industrial technology almost daily adds new factors affecting the quality considerations. Many of these factors are not fully understood and may have long-term effects on users as well as the water quality. The minimum water quality requirements acceptable today may have to be revised in the future.

There is a constant striving by both industries and municipalities for improved water quality control. If the quality of the available raw water continues to deteriorate, as appears likely due to the residual effects of expanding population and industry, improved economical treatment methods must be found. Any water can now be treated to produce a finished water of any desired quality but often treatment by existing methods is not economical. For example, sea water can be effectively desalinated and the present treatment methods are practical for use on shipboard. However, desalination of saline water is not now economically feasible for irrigation.

Whenever the available water quality is not high enough to meet a specific need, the planner has the alternative of finding a use requiring a lower quality, seeking a higher quality source (possibly by more effective upstream pollution abatement), or providing effective treatment of the available source. The final choice between such alternates will be decided on the basis of social, political, and economical considerations.

These guidelines are for use in a broad planning program and are not necessarily applicable for the detailed planning of a specific water use installation. They are in sufficient detail for planning municipal pollution abatement requirements where it is the usual practice to plan for a degree of treatment rather than for removal of a specific pollutant. For simplification only those quality characteristics on which analyses are commonly available or may be readily obtained were included.

The classified water uses are:

1. For domestic, municipal, and food processing
2. For industrial processes other than food processing
3. For water contact sports
4. For other aquatic recreation and esthetic enjoyment
5. For fish and aquatic life
6. For shell fish culture
7. For irrigation

8. For industrial cooling water
9. For stock watering
10. For navigation and hydropower.

Experience indicates that practically any quality water can, by necessity, be used for cooling, navigation, and hydropower. Therefore, no attempt has been made to establish minimum requirements for these purposes.

The minimum acceptable raw water quality requirements were based on the assumption that all waste will receive some degree of treatment before discharge and where possible commonly used treatment methods will be employed to assure a finished water quality suitable for the specific use. However, for uses, such as recreation, the quality of the raw water must be suitable if additional treatment can not be provided.

It is prudent to assume that, for a water polluted with domestic wastes, there is no threshold value for Coliform Bacteria below which there is no possibility of contagion or infection by pathogenic organisms. Waste treatment, including effluent disinfection, will provide a reasonable safeguard, however, as the "Most Probably Number" for the Coliform group increases, the hazards due to the probability of infection is greater. If a high value is set, little or no protection is afforded. If the value is set too low, the costs may outweigh socioeconomic, health or other benefits.

The low alkalinity, of many of the natural waters of the Southeast River Basins area offers poor buffering capacity and the adverse effect of most chemical pollutants is greatly increased. The establishment of numerical values for such substances, for area-wide use, would be too restrictive.

Numerical values for radioactivity in water resulting from waste discharges and fallout are not included. The effects of human radiation exposure are viewed as harmful. Concentrations of radioactivity should be low enough to prevent an intake of radionuclides which would result in a total radiation exposure exceeding the appropriate radiation protection guides recommended by the Federal Radiation Council. Any unnecessary exposure to ionizing radiation should be avoided.

The following values do not mean there is complete safety when concentration are lower nor that a definite hazard exists if the values are exceeded.

The quality requirements apply equally to ground and surface water, except for dissolved oxygen values which apply only to surface waters.

Acceptable Quality of Untreated Water Source

1. Domestic, Municipal and Food Processing Use
 - a. Organisms of the Coliform Group. Mean monthly MPN less than 5,000 per 100 ml
 - b. Floating or settleable solids. None of identifiable sewage or industrial waste origin.
 - c. Total dissolved solids. Average monthly value not over 500 ppm.
 - d. pH 6.5 - 9.01.
 - e. Color less than 100 units¹.
 - f. Dissolved Oxygen — presence increases palatability.
 - g. Chlorides not over 250 ppm.
 - h. Sulphates not over 250 ppm.
 - i. Phenols less than .005 ppm.

- j. Toxic Substances — none in injurious concentrations.

NOTE: Raw water sources acceptable for this use may contain other adverse substances only in amounts amenable to economic treatment. The quality of the finished water shall not contravene the accepted drinking water standard requirements.

2. Industrial Use Process Water (Other than Food Processing).

- a. Total dissolved solids — Average monthly value not over 500 ppm.
- b. pH 6.5 - 9.01.
- c. Chlorides — Not over 250 ppm.
- d. Sulphates — Not over 250 ppm.

NOTE: Process water quality requirements will vary with the type of industry. Chemical quality of available water supply may influence new site selections.

3. Water Contact Sports Use.

- a. Organisms of Coliform group — Mean monthly MPN less than 1000 per 100 ml.
- b. Floating or settleable solids, oil, colored and other waste — None visually identifiable as of sewage or industrial waste origin.
- c. Dissolved oxygen — not less than 4 ppm¹.
- d. pH 6.5 - 9.01.
- e. Toxic substances — none injurious concentrations.

NOTE: Injurious quantities of toxic waste or deleterious substances shall not be discharged so as to adversely affect this use. Effective treatment, including disinfection whenever indicated, *must be provided* all waste prior to their discharge.

4. Other Aquatic Recreation Use and Esthetic Enjoyment.

- a. Floating and settleable solids, oil, colored and other waste — none visually identifiable as of sewage or industrial waste origin.
- b. Dissolved oxygen — aerobic condition should prevail.

5. Fish and aquatic life use².

- a. Dissolved oxygen not less than 4 ppm¹.
- b. pH 6.5 - 9.01.
- c. Phenols — less than .005 ppm.
- d. Oils (including kerosene) — none.
- e. Toxic substances — None in injurious concentrations.

6. Shell Fish Culture Use.

- a. Organisms of Coliform group-median MPN not over 70 per 100 ml.
- b. Dissolved oxygen — not less than 2.5 ppm.
- c. pH 6.5 - 9.01.
- d. Phenols less than .005 ppm.
- e. Oil — none.
- f. Toxic substances — none in injurious concentrations.

¹ Except where natural native value exceed these limits.

² Waters reserved especially for this use should be managed to maintain pH values and oxygen concentrations at natural levels.

7. Irrigation Use.

- a. Organisms of Coliform group — Median MPN not over 70 per 100 ml¹.
- b. Total dissolved solids — Not over 1000 ppm.
- c. Boron — Not over 0.5 ppm.
- d. Chlorides — Not over 250 ppm.
- e. Sodium — Should not exceed 50% of the sum of the calcium and magnesium ions.
- f. Sulphates — Not over 250 ppm.

NOTE: The natural waters of the area have a low alkalinity and little or no buffering capacity. Therefore, the adverse effects of added pollutants are increased. Even very small quantities of some chemicals in the water used for irrigation may adversely affect certain sensitive plants.

8. Stock watering use.

- a. Chlorides — not over 700 ppm.
- b. Fluorides — not over 5 ppm.
- c. Sulphates — not over 250 ppm.
- d. Toxic wastes, oil or deleterious substances — none alone or in combination with other substances or wastes in sufficient amount or at such temperature as to be injurious.

CRITERIA FOR PLANNING TO MEET THE FUTURE MUNICIPAL WATER AND SEWERAGE NEEDS

The design of water and sewerage facilities should be based on the estimated requirements at the end of the expected life period of the structure. The scheduling of construction should take into consideration the present size of the community and its estimated growth pattern, also the maximum demand requirements on, and the expected life of, the needed facility. The adequacy of existing facilities may affect the urgency of need and should be considered in planning enlargements or replacements and in the scheduling of construction.

In the development of these criteria the three sizes of metropolitan area have been chosen and the water and sewerage facilities have been divided into six general categories. The general criteria outlined in the tabulation were developed on the basis of the expected life of each type structure, the maximum demands expected during the period of design and possible economies afforded by phasing of construction. The scheduling of construction should assure adequate capacity for maximum demand at all times.

Water Systems

Ground water sources

The available supply should always equal and preferably exceed the expected maximum demand. Additional wells may be developed as demand increases. Duplication of units is desirable to provide continuous service during maintenance periods. Gas or diesel standby units are essential in case of power failure. The safe yield of the aquifer should be determined in advance of over-develop-

¹ Water used for irrigation of plants frequently eaten uncooked.

ment. This will require a careful study of the aquifer. Such a study should determine the correct well depths and spacing for the most economical development of the resource.

Surface water sources

The water supply requirement should be estimated for end of the period of life of structure when the proposed source is a multiple-purpose or single-purpose artificial impoundment.

Water Treatment Plants

Surface water supplies

The design capacity should be based on maximum requirements expected at the end of the life of structure period. Where the design incorporates multiple identical units such as filters, pump, etc. — space should be provided for all units but construction may be limited to only those needed to provide for the 25th operating year maximum demand.

Ground water supply

Where the treatment of ground water is required the treatment plant capacity should be based on the maximum discharge rate of the pumps.

Elevated storage

In small towns, for normal use, the elevated storage capacity should be at least equal to the daily demand if pumping is limited to the daytime period.

With automatic operation of the pumps throughout the 24-hour period, elevated storage equal to 15-25 percent of the daily demand should be adequate to handle all peak withdrawals except those required for fires.

In larger cities fire pumpers can partly replace the need for fire protection storage capacity providing the system is designed and constructed with large feeder mains in the grid to increase the yield of the distribution system.

One of the more important requirements of a water system is the provision of adequate water available at all times for fire control. This supply of water should be provided at least in part by elevated storage.

For small towns (2,500 or less) a minimum of two 250 gpm standard fire streams for a period of 5 hours is selected as adequate. This would require 150,000 gallons of available water in a 5 hour period. Assuming one pump would produce 150 gpm, elevated storage of 100,000 gallons would be required. In estimating storage requirement for larger communities the value of 40 to 50 gallons per capita would provide 100,000 gallons for towns of 2,500 and 500,000 gallon storage for towns of 10,000. Storage of this magnitude should be adequate to meet the increase in fire protection needs of the medium size communities. In large metropolitan areas complete detail engineering studies should be made to determine all needs.

Sewerage Systems

Sewers

The design of sewer systems should consider the estimated population growth expected in the period of life of structure. The lines should be sized to provide capacity

Criteria for Meeting Water and Sewerage Needs

Size of town	Water source life 100 years	Water treatment life 50 years	Elev. storage on dist. system life 50 years	Distribution system life 75 years	Sewer system life 100 years	Sewage treatment life 50 years
Under 2,500	Develop supply adequate for 50th year demand.	Design and construction based on 50th year demand.	Minimum size 100,000 gal. ¹	Design for 100th year estimated demand. Construct as required.	Design for 100th year estimated demand. Construct as required.	Design and construct on 50th year requirements.
2,500 to 10,000	Well supplies may be developed to meet 25-year requirement. Develop surface supplies for estimated 100th year demand.	Design for 50th yr. demand. Construction of identical units may be scheduled based on estimated 25 year maximum demand. ²	100,000 gals. add additional units based on 40 gal./capita using estimated 25 year increased population.	Design for 100th year estimated demand. Construct as required.	Design for 100th year estimated demand. Construct as required.	Design on 50th year requirement. Construction of identical units may be scheduled based on expected connected load 25th year.
Over 10,000	Well supplies may be developed to meet 25th year requirement. Develop surface supplies for estimated 100th year maximum demand. ²	Design for 50th year demand. Construction of identical units may be scheduled based on estimated 25 year increased population.	500,000 gals. add additional units based on 50 gal./capita using estimated 25 year increased population.	Design for 100th year estimated demand. Construct as required.	Design for 100th year estimated demand. Construct as required.	Design on 50th year requirement. Construction of identical units may be scheduled based on expected connected loading with capacity adequate for 25 years of growth.

NOTES: ¹ Minimum size determined on basis of 2 - 250 gpm standard fire streams for 5 hours and a minimum pump capacity of 150 gpm.

² Treatment facilities for well supplies should be design for maximum discharge rate of pump.

adequate for the ultimate connected load from the entire drainage system the line will eventually serve. The system should be constructed as development requires the service. All towns of approximately 800 population and over should be sewered and the wastes should be treated.

Waste treatment plants

The design of waste treatment plants should be based on the expected loading at the end of the life of structure. The construction may be phased to the expected growth and development whenever the design includes duplicate identical units. The constructed capacity should always exceed the maximum loading. The degree of treatment provided should be adequate to prevent any over-loading of the assimilating capacity of the receiving stream.

Construction Cost

The cost data for water, sewerage and waste handling facilities prepared by the U. S. Public Health Service will be used in estimating the construction costs. For the purpose of project formulation these costs will be amortized at 2½ percent for 50 years. An interest rate of 4½ will later be used (factor for 50 years) for those projects constructed by municipalities.

Only the cost of facilities scheduled for construction to meet present needs in accordance with these criteria will be amortized. Costs of construction for projects to meet the estimated needs of 1975 or 2000 will be shown as total capital expenditure required prior to the indicated date. An estimate of present value of existing structure will be included to indicate present worth.

WORK PLAN - TERMINAL STUDIES FOR WATER SUPPLIES, POLLUTION ABATEMENT AND PUBLIC HEALTH

(edited to delete administrative details)

Section I - Resource Needs in the Southeast River Basins

1. *The following paragraphs in this section give background information concerning resource needs in the Southeast River Basins.*

a. Technical studies for the development of facilities and/or programs for pollution abatement, water supply, waste disposal, vector control, and a general improvement and development of public health are being assembled

by the U. S. Study Commission. Concurrent studies are being carried on in the fields of flood control, recreation, fish and wildlife resource development, hydroelectric power, soil, water, and forestry conservation, irrigation, drainage, and industrial development. The results of studies are being submitted to the U. S. Study Commission for coordination and consolidation into a comprehensive plan for the study area.

b. Plans for multi-purpose projects and programs should meet, as nearly as practicable, all the needs of the related functions in the area. All of the benefits that accrue to the functions and to the area should be considered.

c. The U. S. Study Commission will provide data in technical supplements to the work plan showing the needs to be met by the plan.

Section II - General Statement of Work to be Performed

1. Work to be performed under this work plan broadly involves data collection for use by the Commission in: (a) combining and establishing the projected resource uses to meet the projected needs for the basin in 1975 and 2000; (b) making adjustments to data obtained from basic and functional studies and determining the optimum development to serve the projected needs; (c) checking and adjusting single-function and basic studies and determining the quantities and quality of water and land available for use; (d) making additional studies where required to obtain information needed to develop the comprehensive plan; and (e) in limited cases, make available professional help to assist the U. S. Study Commission staff on temporary details.

The work in this plan will include, but not be limited to, planning studies of potential sites and locations of dams and reservoirs, channels for drainage, irrigation, or navigation, land or water areas for waste disposal, and the consideration of single or multi-purpose sites in connection with all purposes, and the fitting together of all those purposes so that the needs may best be met.

2. The studies under this work plan will be implemented as soon as possible after the agreement and work plan have been approved by the cooperating agency and the U. S. Study Commission. Technical supplements will be submitted to the cooperating agency setting forth the work needed in the studies and the general procedures for doing the work. Work will be grouped as much as practicable into one technical supplement to provide a block of work for an agency. Miscellaneous work may also be implemented under this work plan by means of letters to the cooperating agency.

Section III - Scope

1. The work will be performed in one or more phases of study as set forth in the technical supplements to this work plan. Where more than one phase of study is involved, Phase I studies, in general, will make a preliminary appraisal of the physical and economical potentialities of various proposed programs and projects to determine which ones, if any, should be selected for more detailed study.

2. Additional studies will be a continuation of the Phase I studies for those programs and projects which have been selected for further studies by the U. S. Study Commission. One or more phases of work may be authorized under one or more technical supplements.

3. The study depth and coverage for each phase will be specified in the technical supplement or letter regarding each phase of the work.

Section IV - Guidelines and Criteria

1. The work is to be performed as set forth in this work plan and the appropriate technical supplement and letters. Inasmuch as all the details are not given, the cooperating agency will exercise its best judgment to accomplish the work and to maintain the various parts and phases of the study in relative balance.

2. The fullest use will be made of all data available from the agency's current files and completed studies as well as that made available by the U. S. Study Commission.

3. The criteria to be used in these studies will be in accordance with the Commission's policies and procedural guidelines, a list of which is attached. Generally, when specific criteria are not given, the agency's practices will be followed.

Section V - Study Details

1. The cooperating agency will proceed with the studies as they are set forth in the technical supplements to this work plan. Included in the technical supplement will be information and instructions for the study, such as additional guidelines and criteria and instructions regarding study details and procedures.

2. Technical supplements will be developed in cooperation with the U. S. Public Health Service as needed.

3. Close liaison is contemplated between the designated representatives of the U. S. Public Health Service and the U. S. Study Commission in order that the intent of the work can be understood and the problems resolved to the mutual satisfaction of both agencies. Contact representatives of the U. S. Study Commission will be the basin planning engineer on administrative and comprehensive planning matters and the functional specialist for technical matters.

4. In addition to the work on individual basins, a limited amount of miscellaneous work, such as review of plans, proposals, etc., for the Southeast River Basins area may be needed.

Section VI - Submission of the Results of the Studies

1. The results of the studies will be submitted in technical memoranda to the U. S. Study Commission in quintuplicate. Where two or more phases of studies are involved, each phase of the studies will be submitted as soon as they are completed as outlined in the technical supplements to this work plan covering the work.

2. The technical memorandum will include, but not be limited to, the results of the studies, alternatives considered, the basis for the plans and pertinent data relative to the study and a narrative discussion covering details of procedures and methods used.

3. The technical memorandum will also point out the adequacy or weakness of existing laws or enforcement machinery that may affect proposed projects or programs, in their relationship to water usage, pollution, or public health.

4. The technical memo will also report on the financial aspects and measures that may be needed by industries or local government to implement proposed plans or proposals and also time lags that may be expected because of financing.

SECTION VII - NAVIGATION

General Concept

Improvement and safeguarding of navigation listed in the enabling Act together with the broad directive requiring investigation, study, and promotion of land and water resources in the study area, furnish the guidance under which the navigation studies were made.

The navigation system was studied in three parts:

(1) The inland waterway system including the Savannah River, the Apalachicola-Chattahoochee-Flint Rivers, and other streams which are navigable for some distance inland;

(2) the Atlantic and Gulf sections of the Intracoastal Waterway and adjacent navigable channels;

(3) the inland and coastal harbors, both shallow and deep draft.

Each of these parts was considered by basins insofar as practicable. In general, the sequence of the study in each case was first, to collect and analyze information on existing navigation facilities; second, to estimate existing and future needs for transportation by water; third, to determine what improvements and new facilities would be necessary to meet existing and future needs; fourth, to estimate costs and benefits of the single-purpose facilities for navigation, without regard to other functions which might be competitive for the use of resources; and fifth, to consider the navigation possibilities in concert with other functional plans so navigation could be incorporated in the overall comprehensive plan.

Work Plan

The work plan prepared for the navigation studies is given at the end of this Section.

The work plan states the objectives of the studies, outlines the scope of the work to be

Section VII - Duration of Studies

The due date for completing work under each technical supplement and letter covering the work will be included therein. However, the work contemplated for each basin under this work plan must be completed in accordance with the following tabulation:

(Administrative details)

SECTION VII - NAVIGATION

performed, sets up guidelines for the cooperating agencies, details the studies required, establishes completion dates for their various components, and gives their estimated costs. A three-part technical supplement delineates the portion of the work to be done by each of three cooperating agencies.

Work Performance

The study of transportation and one of the three parts of the navigation study were made by contract with colleges, the former with Georgia State College of Business Administration and the latter with the Georgia Tech Research Institute, a part of the Georgia Institute of Technology. The work under the contract with the Research Institute was performed by the Industrial Development Branch of the Engineering Experiment Station of the Georgia Institute of Technology.

Under its contract, the Georgia State College of Business Administration prepared a report encompassing a description of the present transportation system in the study area; a projected transportation load for the years 1975 and 2000; a description of an efficient transport system for those years; an appraisal of operating costs, regulatory programs, allocations of resources, subsidies and combining of systems; and an assessment of the role of inland navigation.

The Georgia Tech Engineering Experiment Station, under its contract and Part 3 of the Technical Supplement, adapted the results of the United States Study Commission economic studies and information received from other cooperating agencies as a basis for making projections of waterborne commerce on the inland waterways and at the seaports of the study area.

The Board of Engineers for Rivers and Harbors, Corps of Engineers, U. S. Department of Army, by agreement with the U. S. Study Com-

mission and guided by the Technical Supplement, Part 1, made a study of petroleum products requirements and movements including projections to 1975 and 2000; a study of deep-draft bulk and general cargo ships and tankers including future trends; tabulations for the years 1947-58, inclusive, of waterborne tonnages handled at 10 deep-draft ports in and near the study area and on both sections of the Intracoastal Waterway; and least squares trend line projection formulae for commerce at each port and on each section of the Intracoastal Waterway.

An agreement with the U. S. Engineer Division, South Atlantic, Corps of Engineers, U. S. Department of the Army covered the remainder of the work which was the most extensive portion. The major study components, as required by Part 2 of the Technical Supplement, are:

- (1) The 10 deep-draft ports;
- (2) the inland waterway system by basins;
- (3) the ports; and
- (4) the Atlantic and Gulf Intracoastal Waterways.

A field investigation which required 1 to 5 days at each port was carried out by transportation consultants engaged for this purpose. They interviewed officials of the ports and of steamship lines, terminals, truck lines and rail lines, and traffic managers of major industries, and studied shipping records. Data thus obtained were used to show the volume of waterborne commerce handled at each port; its breakdown by standard industrial classifications, origin, and destination; and determination of tributary areas based on the most economical rail freight rate between points in the area and the port.

Commerce projections for the years 1975 and 2000 were made by the Engineering Experiment Station for the Savannah River below Augusta, for the Apalachicola-Chattahoochee-Flint system, and for the deep-water ports of Savannah, Brunswick, Fernandina Beach, Port St. Joe, Panama City, and Pensacola. Projections were based on the assumption that navigation will be extended on the Flint to Albany and on the Chattahoochee to Atlanta between 1975 and 2000. It was further assumed that the authorized Tennessee-Tombigbee Canal, the proposed Trinity River Waterway connecting Dallas and Fort Worth with the Gulf Intracoastal Waterway, and the authorized Cross-Florida Barge Canal will all

be completed prior to 2000; that prior to 1975 either of two developments will take place—the completion of the Cross-Florida Barge Canal or the establishment of at least one oil refinery on the Atlantic coast of Georgia; that inland waterways now under construction and planned inland ports on such waterways will be in service prior to 1975; that established inland waterways and inland ports will be maintained for barge navigation; and that all inland waterways considered will have a minimum project depth of 9 feet.

Projections of inland river traffic, considered in major commodity groupings, were developed from prospective traffic for 1959-60, as a base. Each group was related to an appropriate economic indicator in order to estimate future rates of change. These indicators were developed in the form of multipliers designed to measure the anticipated degree of change from 1959-60 to 1975 or 2000 applicable to a particular commodity's base tonnage. Considerations upon which the indicators were based included the main tributary area, historical trends in traffic tonnage, population and income projections, the rate of change of the gross national product, and projected industrial development.

Projections of port traffic tonnages were made by means of three approaches.

Approach I involved a separate series of projections for foreign and domestic commerce. For each of five major commodity groups and a sixth group representing the remainder of foreign traffic, total foreign traffic for the six study area seaports and the four nearby ports of Charleston, Jacksonville, Tampa, and Mobile was projected by means of least squares trend lines. Projected total tonnages for each commodity group were first allocated to the ports within the study area and those outside the study area on the basis of each port group's share of the 1950-59 cumulative total tonnage. The same method was then employed to allocate total tonnages by commodity group to individual ports with one exception. In the case of gypsum rock, 1959 tonnage was used rather than the 10-year period because of the recent establishment of the gypsum plant at Brunswick. Domestic traffic projections for each port were based on least squares trend line projections for domestic petroleum and petroleum products traffic, 1947 through 1959. These projections were expanded to domestic traffic totals

by dividing by the ratio of domestic petroleum traffic to all domestic traffic. Cumulative totals, 1950-59 inclusive, were used to obtain this ratio. Totals for each port for Approach I were the sums of the separately derived projections for foreign and domestic traffic.

Approach II analyzed the traffic pattern at each port according to areas in which traffic originated or terminated. Traffic originating or terminating in the study area, "inside traffic," was broken down by subarea. Traffic originating or terminating outside the study area, "outside traffic," was broken down by State of origin or destination. Separate sets of projections were made for (1) petroleum and products and (2) all other commodities for each geographic area represented in each port's 1959 traffic pattern. In general, the projections were made by using 1959 traffic tonnages as the base and available economic indexes as indicators of anticipated rates of change. Projections of petroleum and products drew upon certain results in "Study of Trends in Petroleum Supply and Requirements and Tanker Fleets and Characteristics" prepared for the Commission by the Board of Engineers for Rivers and Harbors. Following is an example of the method of projecting to 1975 the petroleum tonnage terminating in the study area for a seaport.

- a—1959 tonnage generated for each subarea
- b—1960 population of the subarea
- c—Projected per capita demand for 1975 in the river basin which includes the subarea
- d—Per capita demand for 1959 in the river basin which includes the subarea
- e—Projected population of subarea for 1975

Then, the projected petroleum tonnage for 1975 is:

$$\frac{a}{b} \times \frac{c}{d} \times e$$

Projections of petroleum traffic for the year were made similarly. For all other traffic, as a group, originating or terminating in the study area, a similar formula was used. For all other traffic, as a group, originating or terminating outside the area, the ratio of the projected gross national product for 1975 (or 2000) to the 1960 gross national product was used as a multiplier and applied to 1959 tonnages.

In Approach III, separate sets of projections were made for each of 10 selected ports—total

traffic for the 6 within the Southeast River Basins and study area traffic for the 4 outside the study area. Commodity groups considered were petroleum and products; gypsum rock; pulp and paper; fertilizer and fertilizer materials; chemicals; sugar; logs, pulpwood, and lumber; and all other traffic tonnage. For each group a projection was made by a method which seemed most appropriate for the products involved. For petroleum, least squares trend lines were fitted to the time series data for the period 1947 to 1959. These were adjusted to reflect the variance by products of the study area future demand as estimated by the Board of Engineers for Rivers and Harbors. For gypsum rock, multipliers involving population and manufacturing employment were used; for pulp and paper, ratios of projected outputs to 1958 output; for fertilizers, ratios of projected study area requirements and agricultural employment to the 1959-60 figures; for chemicals, the ratios of projected outputs for the industry to 1958 output; for sugar, the ratios of projected population to 1960 population; and for logs, pulpwood, and lumber, the ratios of consumption in the major tributary area of the port to 1958 consumption in the same area. The remaining group, classified as all other, was projected by multiplying 1959 tonnage by the arithmetic average of the ratio of projected population to 1960 population and the ratio of projected manufacturing employment to 1960 manufacturing employment, considering the port primary tributary area for each set of data.

Results of the three approaches were consolidated by means of a weighing scheme to obtain adjusted total projected tonnages at each port. The weighing factor for Approach I was the ratio of the port cumulative total tonnages of foreign traffic and domestic petroleum traffic, 1950 through 1959, to its cumulative total traffic tonnage for the same period. For Approach II the port projected total tonnages obtained by that approach were weighed according to the ratio of the port study area traffic tonnage in 1959 to its total traffic tonnage in that year. The weighing factor for Approach III was the ratio of the cumulative total tonnage of the leading commodity groups at the port, 1950 through 1959, to the port cumulative total traffic tonnage during the same period.

For the Atlantic and Gulf sections of the Intracoastal Waterways projections were made by using the trend line formula developed by the Board of Engineers for Rivers and Harbors.

For each basin the responsible District Office of the Corps of Engineers prepared a technical memorandum covering the results of its study of navigation development possibilities. Typically, this technical memorandum briefly described the basin characteristics including topography, land use, natural resources, existing transportation facilities, industrial development, hydrology, and population. The history of navigation was reviewed and commerce movements tabulated for the latest year of record and for a sufficient number of preceding years to establish a trend. A survey was made for the purpose of estimating existing potential traffic for an improved waterway. To gather these data, field parties interviewed potential shippers within an assumed tributary area. Future potential waterborne traffic was estimated, utilizing the projections made by the Georgia Tech Engineering Experiment Station where applicable. All potential traffic was then screened by a rate analysis to determine what portion (prospective traffic) could move by water at a savings over other transportation means. The results of these investigations were shown in the technical memorandum together

with the estimated construction costs, annual equivalent costs, and annual benefits of the considered inland waterway improvements.

For some of the basins the possibilities for development of inland commercial navigation were clearly lacking when engineering and economic feasibility were considered, as in the case of the Ogeechee. Therefore, the technical memorandum reflects detailed study only to the point where such lack could be demonstrated. On the other hand, studies of the Savannah and the Apalachicola-Chattahoochee-Flint system showed much higher prospective traffic movements as well as engineering feasibility and, therefore, warranted a more intensive treatment of costs and benefits.

Separate technical memoranda were prepared for the ports and the two portions of the Intracoastal Waterway.

Memoranda on the ports included a description of the harbor with its approaches and facilities, a tabulation of past and existing traffic, and trips and drafts of vessels.

Memoranda dealing with the existing Atlantic and Gulf Intracoastal Waterways also included descriptive data, traffic tabulations and trips, and drafts of vessels. Included with the Gulf section were a number of short tributary channels and shallow draft harbors.

TABLE 2.11
Waterborne Commerce
(thousands of short tons)

Principal port or waterway	1960 traffic	Projections			
		By trend lines, 1947-58		By economic indicators	
		1975	2000	1975	2000
Savannah Harbor	4,325	---	---	6,735	11,740
Brunswick Harbor	787	---	---	1,004	1,625
Fernandina Beach	149	---	---	342	552
Port St. Joe	1,620	---	---	2,344	3,715
Panama City	1,069	---	---	2,583	4,965
Pensacola	792	---	---	1,439	2,685
Atlantic Intracoastal Waterway	974	2,543	4,683	---	---
Gulf Intracoastal Waterway ¹	1,037	3,173	6,073	---	---
Gulf Intracoastal Waterway ²	2,519	8,002	14,232	---	---
Savannah River	63	---	---	1,399	3,294
A-C-F System ³	405	---	---	2,117	24,230

NOTES: ¹ Apalachee Bay to Panama City.

² Panama City to Pensacola.

³ Apalachicola, Chattahoochee, and Flint Rivers. Extension of navigation on the Chattahoochee to Atlanta assumed prior to the year 2000. Figures based on Commission study and used are 6,259 and 12,904 tons for 1975 and 2000.

An extension of the Gulf Intracoastal Waterway from the existing eastern terminus of the authorized extension of St. Marks along the Florida coast to the Withlacoochee River was studied in some detail. Four schemes with estimated costs and benefits were presented along with background data on existing facilities along the coast and on traffic, including recreational craft.

The Commission supplemented the studies made by the colleges and the Corps of Engineers with its own observations and conclusions on features studied by the cooperating agencies and on any additional items which appeared to warrant investigation.

Coordination

The sequence of the work began with inventory and basic studies and progressed through field surveys, needs and projections to the recommended methods of meeting the needs, and determination of costs and benefits. The Commission furnished guidance in scheduling and coordinating the studies, including the transmission of information and data to and among the various agencies as necessary. Unforeseen delays required curtailment of the studies in some respects. For example, it was not required that the Corps of Engineers submit preliminary plans as such. In most cases, the technical memoranda presented the plans which were considered to best meet the needs. Others were generally disposed of in the course of the study by process of elimination. Also, since no interbasin projects appear feasible and the study area plan for navigation is simply the basin plans combined, no overall study area plan was required.

Throughout the progress of the work, primary coordination was effected by personal liaison between the Commission and the cooperating agencies. Commission personnel worked informally with the various representatives of the colleges and the Corps of Engineers and consulted with other agencies such as the Georgia State Ports Authority and the Savannah District Authority. A representative of the U. S. Engineer Division, South Atlantic, was designated as coordinator of all work performed by the Corps of Engineers. As necessary, representatives of working groups were called together for a general meeting. Four such meetings were held dur-

ing the calendar year 1960 with the Savannah, Jacksonville, and Mobile District offices of the Corps of Engineers, Georgia Tech Engineering Experiment Station, Georgia State College, the Board of Engineers for Rivers and Harbors, and the Commission represented. Many other conferences with one or more of the working group leaders were held to discuss questions involving parts of the studies with which they were particularly concerned.

Findings

Basin Data

With the exceptions of the Savannah and the Apalachicola-Chattahoochee-Flint systems, commercial navigation in the Southeast River Basins is confined to coastal areas and comparatively short reaches of the larger streams.

The Savannah has been improved to provide a channel with minimum dimensions of 9 feet deep and 90 feet wide from deep water in Savannah Harbor to a point 3 miles above the 5th Street bridge in Augusta, a distance of 183 miles. The one lock in the reach, at new Savannah Bluff, has a depth of 10 feet over the sills and a normal lift of 15 feet.

The Ogeechee is considered navigable for about 52 miles above the mouth in Ossabaw Sound. Commercial navigation, however, is practicable to only about mile 31, minimum depths below that point ranging from 6 to 37 feet.

The Altamaha system is considered navigable to Macon on the Ocmulgee and to Milledgeville on the Oconee. However, 3 foot depth is available only about 70 percent of the time. Limited depth, and snags, and other obstructions on the Oconee restrict navigation above Doctortown, at about mile 65, largely to recreational craft.

The Satilla and the St. Marys Rivers are navigable for commercial traffic on their lower reaches, the former for about 44 miles upstream and the latter for about 37 miles. The Nassau is navigable only for small craft because of shallow water and shifting bar near the mouth.

On the Suwannee River a 3½-foot depth is available throughout the year from the mouth to Branford at mile 75. The depths available permit extensive recreational boating, but the river is too shallow for commercial use except for fishing craft near the coast.

In the Ochlockonee basin the small shallow streams do not permit commercial navigation

above tidewater. The only stream which has been improved for barge traffic is the St. Marks which has a 10-foot deep 100-foot wide channel to the town of St. Marks, about 7 miles from the Gulf of Mexico. There is a natural minimum depth of about 7½ feet from St. Marks to Newport, 3 miles upstream.

Improvements now nearly completed (1962) on the Apalachicola-Chattahoochee-Flint system will result in a 9-foot deep, 100-foot wide channel from deep water in Apalachicola Bay to Columbus on the Chattahoochee. A channel of these dimensions already exists on the Flint as far as Bainbridge. The project on the Chattahoochee includes three navigation locks with chambers 82 feet by 450 feet and lifts of 33, 25, and 88 feet.

The two streams in the Choctawhatchee-Perdido basins which once carried inland commercial traffic, the Choctawhatchee and the Escambia-Conecuh, are no longer suitable for modern commerce movements above tidewater. Barge traffic utilizes the lower 7 miles of the Escambia and the lower 10 miles of the Blackwater, another stream flowing into Escambia Bay.

Intracoastal Waterways

The Atlantic Intracoastal Waterway provides a sheltered route, except for short reaches in open sounds, for barges and other shallow draft vessels along the entire Atlantic coast of the study area. The channel is generally 12 feet deep; but in some areas which are subject to shoaling, controlling depths are somewhat less between periods of maintenance dredging. Channel widths are 150 feet in open waters and 90 feet in restricted channels and land cuts. A short alternative route which avoids the open water in St. Andrew Sound has a depth of 7 feet.

The Gulf Intracoastal Waterway from Brownsville, Texas, enters the study area at the western boundary and extends eastward to Carrabelle, Florida, following tidal rivers, dredged channels, and waters protected by coastal islands. Channel width is 125 feet and the depth is 12 feet. An extension to Apalachee Bay and St. Marks is authorized, but no work has been done on this portion. Through traffic east of Carrabelle either skirts the coast to St. Marks or traverses the open gulf to southern Florida ports or the continuation of the protected waterway near Tampa. Numerous spur channels connect the Gulf Intra-

coastal Waterway with shallow draft harbors along its route.

Deep-Water Ports

Six harbors in the study area are classed as deep-water ports, accommodating vessels with drafts over 25 feet. Savannah and Brunswick, Georgia; and Fernandina Beach, Florida, are on the Atlantic coast. Port St. Joe, Panama City, and Pensacola, Florida, are on the Gulf of Mexico.

Savannah has a 36-foot by 500-foot channel across the ocean bar. There are 50 piers and wharves with over 28,400 feet of combined berthing space, depths of water alongside ranging up to 34 feet, and a variety of handling equipment for high speed loading and unloading of bulk cargoes. Numerous shallow draft wharves are provided.

Brunswick has a 32-foot by 500-foot approach channel and inner harbor depths of 27 feet and 30 feet. Terminal facilities comprise 26 wharves and piers, of which 5 accommodate deep-draft vessels. Three of these are equipped for general and bulk cargo handling. The others are at private terminals. Total berthing space is 11,444 feet.

Fernandina Beach has a 28-foot by 400-foot approach channel with 28-foot depth in the harbor also. The portion of the channel across the ocean bar has a 34-foot depth. There are 25 wharves and piers, 3 of which are used by ocean-going vessels, having a total berthing space of 4,973 feet including dolphins.

Port St. Joe has an entrance channel 14 miles long decreasing from 37 feet deep by 500 feet wide at the seaward end to 35 feet deep by 300 feet wide at the harbor turning basin. The turning basin is 32 feet deep except for the 35-foot harbor channel on the landward side. A secondary approach channel about a mile long from St. Joseph Bay to the turning basin is 27 feet deep and 200 feet wide. Terminal facilities provide for both barge and deep-draft commerce. There are three facilities for deep-draft vessels totaling 3,200 feet of waterfront.

The entrance channel to the Panama City Harbor is 34 feet deep and 450 feet wide from the Gulf to Hurricane Island, thence 32 feet deep and 300 feet wide to the terminal. Facilities serve both barges and deep-draft vessels and consist of 26 piers, wharves, and docks with over

11,000 feet of usable berthing space. Of this total, 2,650 feet serve deep-draft vessels.

Pensacola has an entrance channel from the Gulf of Mexico to deep water in Pensacola Bay and an inner harbor channel. The recently authorized project for the port of Pensacola provides for a 35-foot deep by 500-foot wide entrance channel, a 33-foot by 300-foot bay channel and two parallel approach channels leading to the inner harbor, and a 33-foot depth in the inner harbor channel. In 1959 the channel across the entrance bar was enlarged to 37 feet by 800 feet, and a bay channel 35 feet by 800 feet for a distance of 2,800 feet was dredged. A turning and anchorage basin 35 feet deep and 6,000 feet in diameter was also provided. At present two approach and inner harbor channels are 30 feet deep. A third approach channel of the same dimension leads to a privately owned pier to the east of the inner harbor channel. Bayou Chico, a protected inlet to the west of the main harbor, is now served by a 14-foot deep channel. A 100-foot approach channel 21 feet deep, decreasing to 20 feet inside the Bayou, and a turning basin are authorized. Terminal facilities at the main harbor consist of 24 piers, docks, and wharves, including berthing space for 6 deep-draft vessels.

In addition to the six public deep-water ports in the study area described above, the U. S. Government-owned Kings Bay Terminal, located at the end of a dredged channel about 13 miles north of Fernandina Beach, Florida, provides deep-draft facilities. The entrance channel across the ocean bar is 34 feet deep and 400 feet wide. Seven miles inshore it narrows to 200 feet and continues 6½ miles to the terminal which consists of a 2,000-foot long wharf and a service building. The terminal is operated by a shipping company under a lease from the U. S. Army Transportation Corps.

Shallow-Draft Coastal and Inland Ports

Shallow-draft commercial harbors exist on both coasts and on the Savannah, Chattahoochee, and Flint Rivers. Of the coastal harbors, only four handle any considerable tonnages of commercial traffic—St. Marys on the Atlantic and St. Marks, La Grange Bayou (Freeport, Florida), and the lower 7 miles of the Escambia River on the Gulf. At each of the four harbors a single commerce classification predominates.

With the completion of waterways under construction on the Savannah River and the Apalachicola-Chattahoochee-Flint system and the completion of terminals under construction or planned, the inland ports of Augusta, Bainbridge, Fort Gaines, and Columbus, Georgia; Phenix City and Columbia, Alabama; and Chattahoochee, Florida, will be equipped to serve modern barge commerce.

On both coasts and along the inland streams there are numerous small piers, wharves, and landings which are used by fishing and recreational craft.

Comprehensive Plan

The comprehensive plan includes navigation improvements as parts of multiple-purpose developments and as single-purpose projects.

The high cost of improving inland rivers for navigation renders most of the projects considered economically infeasible as single-purpose developments. When combined with other purposes, however, and with costs of multiple-purpose projects allocated to the various purposes, several navigation improvements beyond those now existing or authorized on the Savannah, Chattahoochee, and Flint Rivers become economically feasible.

The increase in traffic expected on both the Atlantic and Gulf sections of the Intracoastal Waterway will require improvements to the waterway itself and to certain tributary channels. By 1975 the maintenance program on both sections should be accelerated to provide continuous authorized project depth of 12 feet. By 2000, the existing 90-foot wide cuts in the vicinity of Savannah should be widened to 150 feet. These improvements are included in the plan.

Other waterway, port, and miscellaneous navigation projects in the plan are listed below by basins.

Savannah Basin

Twelve-foot slack-water navigation on the Savannah River below Augusta after 1975; with locks being incorporated in the multiple-purpose dams at the time the dams are constructed.

Enlargement of channels and turning basins at Savannah Harbor by 1975 and construction of 12 new deep-draft berths between 1975 and 2000.

Ogeechee Basin

No navigation projects are included in the plan for this basin.

Altamaha Basin

A canalized waterway with 9-foot project depth from deep water in Altamaha Sound to Doctor-town, Georgia, at mile 59. The plan consists of two low-head dams and locks. The project would be built after 1975.

Satilla-St. Marys Basins

Enlargement of channels at Brunswick and construction of one additional deep-draft berth and terminal facility after 1975.

Enlargement of channel at Fernandina Beach and construction of one additional deep-draft berth and terminal facility after 1975.

Removal of shoals in the channel of Umbrella Creek to restore its usefulness to small craft. This project is included in the early action phase of the plan.

Suwannee Basin

For early action, a small boat channel 5 feet deep from East Pass in the Suwannee delta to West Gap, a natural gap through Suwannee Reef to deep water in the Gulf of Mexico, is included in the plan.

Ochlockonee Basin

The Gulf Coast Improvement project, a multiple-purpose project incorporating a dredged channel for barges and recreational craft along the Florida west coast from Apalachee Bay to Cedar Key. Planned for development between 1975 and 2000, other purposes served would be recreation, wildlife and sport fisheries, commercial fisheries, drainage, public health, land transportation, and landfill.

An improved channel for small craft in the Steinhatchee River from the end of the existing channel improvement near the mouth to a point about 8 miles upstream. This work would be done after 1975.

An extension of the existing protected channel of the Gulf Intracoastal Waterway near Carrabelle, Florida, across St. George Sound, Alligator Harbor, and St. James Island to Apalachee Bay. This extension would be 12 feet deep and 125 feet wide, minimum. The work would be done after 1975.

Enlargement of the existing barge channel in

the St. Marks River and the turning basin at the town of St. Marks; and extension of a new channel from the turning basin about two-thirds of a mile upstream. This improvement is in the early action phase of the plan and was in progress in 1962.

For early action, a small boat channel from the public pier at Panacea, Florida, to deep water in Apalachee Bay. This work was nearing completion in 1962.

Apalachicola-Chattahoochee-Flint Basins

By the year 2000, a 9-foot barge waterway on the Chattahoochee River from Columbus to Atlanta as part of a multiple-purpose development.

After 1975, a 9-foot barge waterway on the Flint River from Bainbridge to Albany as part of a multiple-purpose development.

For early action, three multiple-purpose dams on the Flint River above Albany for partial regulation of the Flint and Apalachicola Rivers, with benefit to navigation and other purposes.

For early action, dams at West Point and Cedar Creek on the Chattahoochee with provision for construction of navigation locks in the future.

Choctawhatchee-Perdido Basins

By 1975, one additional deep-water berth with channel improvements and rail service at Port St. Joe. By the year 2000, two additional deep-water berths.

By 1975, one additional deep-water berth with rail connection, enlargement of the entrance channel and extension of the harbor channel and turning basin at Panama City. By the year 2000, two more deep-draft berths and further extension of the harbor channel and turning basin.

By 1975, enlargement of the entrance and harbor channels at Pensacola. After 1975, an additional deep-draft tanker berth and terminal.

Enlargement of the existing Gulf County Canal, connecting the Gulf Intracoastal Waterway with St. Joseph Bay, to the Intracoastal Waterway dimensions. This project would be for early action.

For early action, improvement of the existing Perdido Pass Channel connecting Perdido Bay and the Gulf of Mexico to serve recreational and fishing craft.

TABLE 2.12
Summary of Benefits and Costs of Navigation Developments by Basins
 (thousands of dollars)

Basin	Total program				
	Benefits Annual equivalent	Costs			
		Annual equivalent Total	Annual equivalent OM&R	Invest- ment	OM&R at year 2000
Single purpose					
Savannah	11,780	8,780	7,320	32,380	7,320
Ogeechee	—	—	—	—	—
Altamaha	1,240	852	222	18,130	222
Satilla-St. Marys	1,066	1,188	711	10,890	711
Suwannee	11	9	7	70	7
Ochlockonee	401	248	44	5,700	44
A-C-F	—	—	—	—	—
Choctawhatchee-Perdido	3,897	3,261	2,520	16,490	2,520
Subtotal	18,395	14,338	10,824	83,660	10,824
Multiple purpose					
Savannah	803	827	82	38,150	155
Ogeechee	—	—	—	—	—
Altamaha	—	—	—	—	—
Satilla-St. Marys	—	—	—	—	—
Suwannee	—	—	—	—	—
Ochlockonee	299	291	27	7,330	27
A-C-F	10,673	10,975	1,170	272,490	1,172
Choctawhatchee-Perdido	—	—	—	—	—
Subtotal	11,775	12,093	1,279	317,970	1,354
Total	30,170	26,431	12,103	401,630	12,178

Bibliography

Prepared specifically for the Commission:

U. S. Department of the Army, Corps of Engineers, Board of Engineers for Rivers and Harbors, Washington: *Waterborne Commerce at Southeast Seaports and on the Intracoastal Waterway, 1947-58*, 1960.

Study of Trends in Petroleum Supply and Requirements and Future Tanker Fleets and Characteristics, 1961.

General Cargo Vessels, Trends and Characteristics, 1961.

U. S. Department of the Army, Corps of Engineers, South Atlantic Division, Atlanta:

Report and Summary of Southeast River Basins Traffic Study on Waterborne Commerce. Charles L. Clow, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Charleston, South Carolina. Thomas J. Donovan, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Savannah, Georgia. James H. John, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Brunswick, Georgia. James H. John, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Fernandina, Florida. James H. John, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Jacksonville, Florida. James H. John, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Tampa, Florida. Bryan Cornwell, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Port St. Joe, Florida. Bryan Cornwell, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Panama City, Florida. Bryan Cornwell, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Pensacola, Florida. Charles L. Clow, Consultant, 1960.

Report on Southeast River Basins Area Study of Traffic Flow via the Port of Mobile, Alabama. Charles L. Clow, Consultant, 1960.

U. S. Department of the Army, Corps of Engineers, Savannah District:

Navigation Study, Ogeechee River Basin, 1960.

Letter Report on Kings Bay Terminal, Georgia, 1960.

Navigation Study, Satilla River Basin, Georgia, 1960.

Navigation Study, St. Marys River Basin, Georgia and Florida, 1960.

Navigation Study, Altamaha River Basin, Georgia, 1961.

Phase II Terminal Studies, Altamaha River Basin, Georgia, for the U. S. Study Commission, 1962.

Navigation Study for the U. S. Study Commission, Savannah Harbor, Georgia, 1961.

Navigation Study, Savannah River Basin, Georgia, 1961.

Supplement No. I to Navigation Study, Savannah River Basin, Georgia, for U. S. Study Commission, 1961.

Navigation Study for U. S. Study Commission, Atlantic Intracoastal Waterway, 1961.

Navigation Study for U. S. Study Commission, Darien Harbor, 1961.

Navigation Study for U. S. Study Commission, Fernandina Harbor, Florida, 1961.

Navigation Study for U. S. Study Commission, Brunswick Harbor, Georgia, 1961.

U. S. Department of the Army, Corps of Engineers, Jacksonville District:

- Navigation Study, Nassau River Basin, Florida*, 1960.
- Navigation Study, Gulf Intracoastal Waterway, Florida (Jacksonville District) for U. S. Study Commission, Southeast River Basins*, 1961.
- Navigation Study, Suwannee River Basin, Georgia and Florida*, 1961.

Letter Report on Suwannee Basin, East Pass-West Gap Channel.

U. S. Department of the Army, Corps of Engineers, Mobile District:

- Navigation Study, for the U. S. Study Commission, Choctawhatchee River and Tributaries, Florida and Alabama*, 1961.
- Basin 6, St. Marks River-Ochlockonee River*, 1960.
- Navigation Study, for the U. S. Study Commission, Escambia-Conecuh River Basin, Florida and Alabama*, 1962.
- Basin 8, Perdido River to Choctawhatchee River, Florida and Alabama*, 1962.
- Coastal Channel and Harbor Projects, Part I, Deep Draft Harbors-Pensacola Harbor, Florida; Panama City Harbor, Florida; Port St. Joe Harbor, Florida*, 1961.
- Coastal Channel and Harbor Projects, Part II, Shallow Draft Harbors and Channels-Gulf Intracoastal Waterway; East Pass Channel, Florida; La Grange Bayou, Florida; Apalachicola Bay, Florida; Carrabelle Bay and Harbor, Florida*, 1961.
- Coastal Channel and Harbor Projects, Part III, Additional Outstanding Studies*, 1961.
- Navigation Study for the U. S. Study Commission, Ochlockonee River Basin, Florida and Georgia-Basin 6, Terminal Studies*, 1962.
- Navigation Study for the U. S. Study Commission, Apalachicola River System, Alabama, Florida, and Georgia, Basin 7*, 1962.

White, Lamar and Riddle, Mary. *Memorandum Report Number One, Data on Port Tributary Areas*, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, May 1961.

White, Lamar and Riddle, Mary. *Memorandum Report Number Two, Projections of Waterborne Commerce at Selected Deep Water Ports*, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, June 1961.

White, Lamar; Riddle, Mary; and Conklin, Vivian G. *Memorandum Report Number Three, Waterborne Commerce Projections for Inland Waterways and Inland Ports, Southeast River Basins*, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, November 1961.

Lemly, J. H. *Transportation Resources and Potentials Within the Southeast River Basins*, Georgia State College of Business Administration, Atlanta, 1961.

References used but not prepared for the Commission:

- U. S. Department of the Army (Corps of Engineers) and U. S. Department of Commerce (Maritime Administration):
- Ports on the South Atlantic Coast of the United States, Port Series No. 16*, U. S. Government Printing Office, Washington, 1955.
- Ports on the Gulf Coast of the United States, Port Series No. 19*, U. S. Government Printing Office, Washington, 1959.
- U. S. Department of the Army, Corps of Engineers: *Annual Report of the Chief of Engineers, U. S. Army on Civil Works Activities, Volume 2*, U. S. Government Printing Office, Washington, 1960.
- Bridges Over the Navigable Waters of the United States, Parts 1 and 2*, U. S. Government Printing Office, Washington, 1961.
- U. S. Department of the Army, Corps of Engineers, North Atlantic Division. *Waterborne Commerce of the United States, Calendar Year 1960, Part I*.
- U. S. Department of the Army, Corps of Engineers, Lower Mississippi Valley Division. *Waterborne Commerce of the United States, Calendar Year 1960, Part II*.
- U. S. Department of the Army, Corps of Engineers. *The Intracoastal Waterway, Atlantic Section*, U. S. Government Printing Office, Washington, 1961.
- U. S. Department of the Army, Corps of Engineers. *The Intracoastal Waterway, Gulf Section*, U. S. Government Printing Office, Washington, 1961.
- U. S. Department of the Army, Corps of Engineers, South Atlantic Division, Atlanta:
- Water Resources Development by the U. S. Army Corps of Engineers in South Carolina*, January 1961.
- Water Resources Development by the U. S. Army Corps of Engineers in Georgia*, 1961.
- Water Resources Development by the U. S. Army Corps of Engineers in Florida*, 1961.
- Water Resources Development by the U. S. Army Corps of Engineers in Alabama*, 1961.
- U. S. Department of the Army, Corps of Engineers, Savannah District:
- Brunswick Harbor, Georgia, Restudy Navigation Report*, 1959.
- Project Maps, River and Harbor and Flood Control Works*, 1960.
- U. S. Department of the Army, Corps of Engineers, Jacksonville District. *Project Maps*, 1960.
- U. S. Department of the Army, Corps of Engineers, Mobile District. *Project Maps of the Mobile District*, 1960.

Fay, Spofford and Thorndike, Inc. *Report and Master Plans, Port of Savannah*. Prepared for Georgia Ports Authority, Boston, April 1958.

Blicksilver, Jack and Bowdoin, Mary H. *The Impact of Georgia Ports Upon the Economy of the State*, Georgia State College of Business Administration, January 1960.

Supplemental Data

The work plan follows. Other pertinent data on navigation studies are included in the files of the Commission.

WORK PLAN - NAVIGATION

{edited to delete administrative details}

I. Introduction

Public Law 85-850 requires the formulation of a comprehensive and coordinated plan for "the improvement and safeguarding of navigation." This is interpreted to mean that the portion of the comprehensive plan dealing with navigation is to encompass existing navigation facilities; improvements and additions to those facilities, if required for the ultimate development of a system; and provision of new navigation facilities or systems if found warranted for the ultimate development of the entire area.

Development for navigation, whether we are considering improvement of an existing system or establishment of a new system, is dependent for justification on the traffic potential. This, in turn, is dependent upon commercial and industrial development, population growth and trends, alternative transportation systems, and other factors. Such development must also be justified on the basis of cost as determined from engineering and economic estimates.

The preliminary plan will be developed primarily on the basis of traffic potential as estimated from projections made by SAD and the Board of Engineers for Rivers and Harbors and by the colleges under their existing contracts with the Commission and especially from the data prepared by Georgia Tech.

II. Objective

To collect, assemble, and analyze information on existing navigation facilities, trends in sizes and characteristics of ships, barges and other vessels, trends in commodity movements and volume and future traffic potential; and from this data to formulate first a preliminary plan for navigation development in the study area, and then a modified plan which will be joined with those prepared for the other functions to form a combined comprehensive plan for total resource development in accordance with Public Law 85-850.

III. Scope

The preliminary plan will be of the "reconnaissance" type and may consist of several alternatives. It will serve to eliminate from further consideration those projects which are shown to be impractical or otherwise undesir-

able for construction within the time for which projections are made. The modified plan will be the result of alterations to the preliminary plan which are necessary for refinement. Construction cost estimates for the preliminary plan will be of only that degree of approximation necessary for comparison of proposed projects or for comparison with other transportation means. Construction cost estimates for the modified plan will be such that they may be used, with other factors, in forming a reasonable basis for justification.

IV. Guidelines

The Corps of Engineers, U. S. Army, has for many years been charged by law with the construction, operation, and maintenance of the navigable waterways of the U. S. In the performance of these duties, the Corps has developed extensive inland and intracoastal navigation routes and improved facilities at sea ports and river ports, and has kept records of waterborne commerce movements. Therefore, the Corps of Engineers will supply much of the physical and economic data in connection with navigation studies and will provide guidance in applying these data to planning for possible further navigation development.

The Board of Engineers for Rivers and Harbors will first make certain inventories of sea-going vessels and their characteristics; forecasts of trends in future vessel construction; an analysis of the relationship of vessel characteristics to port facilities; and an analysis of existing commerce at deep draft ports in and close to the study area, and in the Intracoastal Waterways. The Corps of Engineers offices in the Study Area, under the supervision of the South Atlantic Division Engineer, will collect, compile, and analyze field data and will delineate the tributary area for each port. The Georgia Tech Research Institute, under contract to the Commission, will adapt their previous economic studies to individual port tributary areas and will make projections of commerce by commodities and tonnages to 1975 and 2000 based on their own forecasts of the regional economy.

The South Atlantic Division, Corps of Engineers, will make similar studies of the various components of the inland waterway system and of the shallow draft harbors thereon, except that projections of commerce movements, as in the port studies, will be made by Georgia Tech in coordination with their previous economic studies.

Navigation needs are closely allied to industrial development and studies of these two functions will be co-ordinated as necessary. Navigation development is affected by development for other functions, principally flood control and hydroelectric power, and the comprehensive plan for the area must consider plans for these and other functions.

Other factors which it will be necessary to consider in the navigation plan are bridge clearances and the possibility of tolls. A study of the bridge clearances on the Atlantic Intracoastal Waterway has been issued by the Corps of Engineers. The Department of Commerce is making a study of waterways in the United States with reference to tolls. Such results as are available from these

studies and pertinent to the navigation plan for the study area will be utilized.

In developing both the preliminary and the modified plan, the completion of the studies by basins will be as follows, insofar as practicable:

Ogeechee Basin
Satilla-St. Marys Basins
Suwannee Basin
Ochlockonee Basin
Choctawhatchee-Perdido Basins
Savannah Basin
Apalachicola-Chattahoochee-Flint Basins
Altamaha Basin

In addition to the study by basins, separate studies will be made for the coastal harbors and for the Atlantic and Gulf Intracoastal Waterways.

V. Work Outline

A. Definitions, Planning Criteria, Standards.

B. Technical Tasks

I. Basic data and analysis

a. Study of petroleum products requirements

- (1) Production, consumption and reserves of crude petroleum
 - (a) Total U. S.
 - (b) By region, including the Southeast area
- (2) Production and consumption of products
 - (a) Total U. S.
 - (b) By region, including the Southeast area
- (3) Projection of requirements to 1975 and 2000, U. S. and regional
 - (a) Requirements to 1975 and 2000
 - (b) Relation of indigenous reserves and production to requirements
 - (c) Crude and product movements to meet requirements for 1975 and 2000

b. Study of imports, exports, and coastwise movements

- (1) Study of tankers (U. S. flag and world fleets)
 - (a) Present composition of fleets
 - (b) Characteristics, including number of vessels, dead-weight, age, speed, cargo transfer facilities, distribution, draft and T-2 equivalents
 - (c) Present construction and trends
 - (d) Total tonnage to meet 1975 and 2000 requirements
 - (e) Distribution of future tanker fleets by vessel size and characteristics
- (2) Study of vessels carrying bulk cargoes other than petroleum, particularly ores
 - (a) Area requirements
 - (b) Vessel trends and characteristics
- (3) Study of general cargo vessels
 - (a) Area requirements
 - (b) Vessel trends and characteristics
- (4) Relation of fleet characteristics to port facilities

c. Study of port deep draft commerce and Intra-coastal Waterway commerce

- (1) Analysis of existing port deep draft commerce and of Atlantic and Gulf Intra-coastal Waterway commerce for period 1947-1958. Ports considered will include Charleston, Jacksonville, Tampa, and Mobile, in addition to those within the study area
 - (a) Trend of major commodities
 - (b) Trend of total commerce
- (2) Field investigation consisting of one to five days at each port to interview port officials, officials of steamship lines, terminals, truck lines and rail lines and traffic managers of major industries
- (3) Compilation and analysis of field data.
- (4) Delineation of tributary area for each port
- (5) Adapt university studies to individual port tributary areas
- (6) Based on university forecasts of regional economy, make a projection of commerce to 1975 and 2000

d. Study of the inland waterway system by basins (to be coordinated with waterways outside the study area as appropriate)

- (1) Trend in characteristics of river traffic including barges, towboats, rafts, and pleasure craft and size of tows
- (2) Economic study of commerce movements.
 - (a) For the period 1947-1958
 - (b) Existing commercial and recreational use of waterways
 - (c) Projection of commerce movements to 1975 and 2000 by commodities and tonnages in coordination with college contract projections. This projection will take account of the effect of possible new industries on river traffic location, character and volume
- (3) Inventory study of existing shallow draft and deep draft harbors to which the components of the inland waterway system are tributary, in terms of water depths, commercial terminal facilities, etc.
- (4) From an analysis of present overland traffic in the tributary areas, estimates of traffic suitable for inland waterway movement, by principal commodity or related commodity group
- (5) Results of sample survey of not less than three existing inland waterway ports to show tonnages, by principal commodity or related commodity group, to consignees or from shippers
 - (a) located directly on the waterway
 - (b) not directly on the waterway, but located less than 50 miles by highway or rail from the waterway terminal used
 - (c) located 50 miles or more by highway or rail from waterway terminal used

2. From the economic projections of population, industry and commerce in the years 1975 and 2000 determine a preliminary general program of rehabilitation, improvement, extension and new construction of navigation facilities to meet the needs indicated by these projections. The program will include, but will not be limited to, consideration of extension of navigation on the Chattahoochee to Atlanta; on the Flint to Albany; on the Savannah to Augusta; and in the Altamaha Basin to Milledgeville and Macon. It will also include possible inter-basin routes.
3. Preliminary Cost Estimates
 - a. For improvements, extensions and new construction of inland waterway facilities included in paragraph 2
 - b. For improvements, extensions and new construction of deep draft port and Intracoastal Waterway facilities included in paragraph 2
 - c. For improvements, extensions, and new construction of shallow draft harbors and channels included in paragraph 2
4. Develop a modified plan, taking into account the preliminary cost estimates and any physical, legal, or other factors, including bridge clearances and the possibility of tolls
5. Modify cost estimates to suit modified plan

C. Technical Programming (Administrative details)

SECTION VIII – RECLAMATION, IRRIGATION, AND DRAINAGE

General Concept

Drainage is the principal method of reclaiming land in the study area and reclamation and drainage are considered synonymous in the Commission studies. Irrigation in the humid Southeast provides opportunities for more efficient farming but normally is not essential for growing of crops. Irrigation and drainage study results are reported separately.

Drainage and irrigation studies have been made from the viewpoint of agricultural production and from the viewpoint of conservation. The latter includes consideration of preserving and wisely using the natural land resources which are vitally effected by land-use changes. Land-use changes stem from other resource developments that take place due to the general population increase, especially when the populace becomes more urban. Individual owners have considerable latitude in the selection of alternative land uses.

Irrigation and drainage are logical developments, especially from a basin or local point of view, because the resource base is expanded and the income of the basin and of individual farmers is increased. With this concept, irrigation and drainage become a foundation for the development of more intensive agricultural activity which provides in itself the basis for nonagricultural economic development.

Within each of the eight basins, areas exist that have significantly physical differences. Consideration was given to soils, topography, growing season, rainfall, project development problems, and needs for development as related to the Blue Ridge, Piedmont, and Coastal Plain provinces.

Drainage Concept

Lands were inventoried as to need of and feasibility for drainage. There are many acres of flood plain lands along the major streams which, because of frequent flooding, are limited to uses which are economic under the degree and frequency of flooding which can be expected. For the drainage studies, it was presumed that the comprehensive plan would include flood control measures which would eliminate or reduce the flooding potential on these flood plain lands.

Drainage plans were designed to provide practical and economic solutions for major segments of the problem. The drainage plans discussed in this Section substantially involve cropland and pasture. It was determined early in the studies that very limited major drainage improvements had been installed in the Southeast River Basins area.

Drainage studies involved locating and identifying major concentrations of lands having problems of wetness and identification and discussion of the associated problems. It is recognized that a large portion of the wetlands in the Lower Coastal Plain are lowlands characterized by a high water table and heavy soils of very low permeability.

Irrigation Concept

The irrigation concept is to present an analysis of past and present irrigation development and future irrigation potentials and consider how to utilize more efficiently the natural resources of the Southeast River Basins area, including all types of irrigation and sources of water supply from either ground or surface waters.

In evaluating needs for irrigation, it is recog-

nized that new lands and/or new resource development will be necessary to replace productive agricultural lands being taken for nonagricultural purposes, such as urban growth, industrial development, highway construction, and losses due to erosion.

Water requirements were determined by an analysis of rainfall records, the probability of rainfall occurrence, consumptive use of crops, expected rainfall effectiveness, and field application losses and efficiencies. The kinds and acreages of crops and pasture irrigated and the estimated gross annual amount of water used in irrigating these crops were computed by the Blaney-Criddle method and based on the assumption that the required water for each crop was applied. An inventory of lands that are considered suitable for irrigation development and estimates of water supply available for irrigation use and related information are included.

Status of and requirements for technical and other services were considered. Studies were made of needs for irrigation including periods of drought or deficient rainfall. These data were used to assist in formulating an overall plan for irrigation development as envisioned for 1975 and 2000.

Definitions and Criteria

In performing the studies and investigations essential to formulating plans for these purposes, it was necessary to define in the beginning the scope of irrigation, drainage, and reclamation as it applies to the Southeast River Basins. In this Section, project action means group performance by two or more entities.

Irrigation is the artificial application of water to agricultural crops under a planned system and in accord with crop needs, soil characteristics, topography, and other pertinent factors. The application of irrigation water is mainly by sprinkler systems utilizing perforated pipes and nozzles rather than by canal systems. A limited amount of furrow and subsurface irrigation is practiced in the Southeast River Basins area. Irrigation in the Southeast River Basins area is generally considered as supplemental and designed to provide moisture for plants during periods of rainfall deficiency.

Reclamation or drainage is the removal or control of excess water from the ground surface or within the soil profile by surface ditches, or

subsurface drains, or by other engineering works, to the extent necessary to provide good growth of desired crops.

Sources of excess water are rainfall, irrigation waste water, underground seepage, floodwaters from channels, or water applied for special purposes such as leaching of saline soils. Drainage embraces both onfarm and project-type systems. The former consists of the onfarm works installed as a part of group action or by individual landowners. Project type systems and small group systems estimates in this study do not include the onfarm works but do include the off-farm works needed to provide outlets for the onfarm systems. Lands which are frequently wet or inundated due to rainfall on the land itself are considered in need of drainage. Lands which suffer from the same sort of damage due to floodwaters from heavy precipitation on other lands are considered in need of flood control improvements.

Major drainage improvements are improvements of a natural waterway including its tributaries, or of an existing artificial waterway, or construction of new artificial drainage channels, if more effective and economical than improvement of existing drainage courses, to provide outlets for water collected or to be collected by the drainage works. The division point between flood control and major drainage works cannot be defined rigidly but should depend on the area and number of ownerships involved, the size of the works at that point, the actual or apparent division between flood and local drainage problems as such, and other unique factors that may appear in specific cases.

The term wetlands refers to lands that are frequently subject to a degree of surface or subsurface concentration of water caused by a high water table or by temporary flooding that prevents or limits use of conservation farming systems. Wetland areas were studied to determine those areas physically and economically feasible for improvement by drainage.

Problems of surface and subsurface wetness of soils and the correction of these conditions on cropland and pastureland, existing and potential, were studied.

Work Plan

Work plans for drainage and irrigation utilized the considerable store of information ob-

tained through the agricultural studies made for the Commission by the land-grant colleges. These are described in Appendix 9. Also used was data from the Department of Agriculture Soil and Water Conservation Needs Inventory, including a special tabulation made by the Iowa State University Statistical Laboratory.

The initial work on determining the scope of the studies to be covered by work plan was started in November 1959, with the making of an evaluation of the quality, extent, and usability of the basic data available on irrigation and drainage. It was disclosed early that limited data existed as to the extent and location of irrigation developments in the study area. It was readily apparent that the location, areal extent and characteristics of wetlands in the study area were inadequately known. As a result of these and other evaluations, an identification of the gaps in basic data was made. Consideration was given to ways and means of filling the gaps in basic data.

A work plan was prepared setting forth the requirements of studies of drainage and irrigation. Subsequently, a committee of Federal and State agencies specialists, having an interest in and technical knowledge of irrigation and drainage, submitted their comments on the contents of the work plans. This committee was composed of representatives of interested State agencies, the U. S. Department of Agriculture, and the Corps of Engineers. The committee was concerned primarily with the identification of basic data needed and review of proposals for work assignments to be performed by other agencies. The committee served strictly in an advisory capacity. The work plans for irrigation and drainage include a general statement, definitions, and purpose of studies; establish guidelines; and most importantly show outlines of items of study to be performed. Copies of the work plans are included at the end of this Section.

More detailed items of study on irrigation and drainage were developed into technical supplements to the work plans. The technical supplements contain study items on basic data; outline requirements for detailed studies on the 1960 situation, conditions and facilities; and list specifications for preparing first estimates of future needs for irrigation and drainage resource development.

Work Performance

Work carried out for drainage and irrigation consisted of that performed through agreement with the U. S. Department of Agriculture and that performed by the Commission staff and consultants.

Agreements were made between the Study Commission and the cooperating agencies in the U. S. Department of Agriculture for performance of studies described in the work plan. Functional work plans and technical supplements thereto containing the items of study were furnished to the cooperating agricultural agencies. Agreements with the Soil Conservation Service provided for that agency to furnish technical data from its files and do field work on study items for drainage and irrigation, to participate in plan formulation as requested, and to perform other related work as specified in the agreement and supplements thereto. Studies made by the Soil Conservation Service included the gathering of extensive inventory data and estimates of future developments for drainage and irrigation.

In order to supplement available data, data sheets were prepared by the Soil Conservation Service to collect information on irrigation and drainage. These were sent to every work unit office of the Soil Conservation Service in the Southeast River Basins area. The information supplied from the field was compiled and prorated, where necessary, to each individual basin area. In addition, a data sheet prepared and distributed to the State offices of Soil Conservation Service in Georgia, Florida, Alabama, and South Carolina was used by their watershed planning parties in the development of data for use in project type work including drainage.

Irrigation guides and drainage guides previously prepared by the Soil Conservation Service for each State were used as references in developing irrigation and drainage cost data. Some cost data for various irrigation systems and crops were supplied by the Economic Research Service. This cost data and information from State colleges and the Bureau of the Census were used in developing costs of irrigation for specific crops as shown in the plan by basins.

An agreement was entered into with the U. S. Department of Agriculture in the form of six study items which constitute a "Technical Supplement for Basic Economic Studies" by the

Economic Research Service. The details and specific working procedures for this work were incorporated into a "Supplement to Technical Supplement for Basic Economic Studies" by U. S. Department of Agriculture. Appendix 9, Economics, contains summaries of these two agreements. One item provides for projecting agricultural yield levels anticipated for all major crop and pasture enterprises under different management levels and production conditions in 1975 and 2000. The production conditions considered included land drained, irrigated and drained-irrigated, and without drainage or irrigation.

Another work agreement provided for the Economic Research Service to furnish net return data from development and usage to drainage and irrigation; yield response from drainage; total production for all crops and pastureland by basins and soil groups as affected by drainage and irrigation; and expected increase in crop value due to irrigation and drainage.

The Economic Research Service with assistance from the Soil Conservation Service furnished a compilation of the soils groups by basins showing the expected crop yields for each soil group at three different levels of management.

The Statistical Laboratory of Iowa State University at Ames, Iowa, compiled Conservation Needs Inventory data on statistical tapes by basins in two different forms, including basin areas and by counties or portions of counties within each basin. CNI along with other inventory data was used to determine soils groupings for yield and other purposes, tabulation of soils with irrigation and drainage problems, and the tabulation of land capability classes by land area and land uses.

Conservation Needs Inventory data compiled by the U. S. Department of Agriculture constitute the source of a major segment of the basic data included in the technical memoranda. Estimates for the year 2000 are based on projections of the 1975 Conservation Needs Inventory. Areal extent of land with dominant problems of excess water, land not feasible to drain, acreage of irrigable land, and project potential for irrigation and drainage were some of the significant data provided from the Conservation Needs Inventory. This inventory is a systematic collection of facts for each county, watershed, and river basin regarding such items as the soil resources, the

problems in soil use, and the estimated areas needing treatment.

In addition to the Conservation Needs Inventory data, information used in performing the studies came from the sources referenced in the Bibliography at the end of this Section.

Concurrent with the U. S. Department of Agriculture studies, the Commission staff used the agricultural information shown in Appendix 9, Economics. This appendix contains 1960, 1975, and 2000 national and Southeast River Basins area projected production and acreage requirements and yields by commodities; estimates land uses, farm income, production expenses, number and size of farms, and capital investment; summarizes land data by major provinces and States; and makes conclusions concerning resource development. The projections were used as guideposts in the development of a framework for resource use and development and as an aid in solving potential conflicts between competitive resource uses. While agricultural production requirements are shown in Appendix 9, it contains no estimate of resource development programs that may be required.

The first phase of operations by the Soil Conservation Service involved the preparation of a total of 16 irrigation and drainage technical memoranda which were completed as of June 1, 1961. Included in the technical memoranda are standard tables and appropriate narratives. The narratives explain tabular data, contain results of items of studies, and include supporting material and certain criteria followed by the agency.

With appropriate review and revision by the Commission, the technical memoranda served as a basis for functional memoranda developed by the Commission. The technical memoranda also served for reference use in formulating both the single-purpose irrigation and drainage plans and the comprehensive plans for land and water resource development.

Following the submission of the technical memoranda by the Soil Conservation Service, a work plan was developed for terminal studies involving additional data and assistance in the expansion and interpretation of technical memoranda information on irrigation and drainage. These terminal studies were likewise covered by a terminal studies work plan with a terminal

studies technical supplement setting forth the specific study items to be performed by the Soil Conservation Service.

Terminal study items required a large amount of field work by the Soil Conservation Service to determine soils conditions, site conditions, existing cover conditions, and some field engineering survey work for use in cost estimation and estimation of crop production. Local field personnel of the Soil Conservation Service assisted in the securing of field data.

Prior to submitting the results of the studies to the Study Commission, the study results were reviewed, correlated, and approved by the U. S. Department of Agriculture through its Southeast Field Advisory Committee. This group designated by the Secretary of Agriculture included as Chairman, the Commission member representing the Department of Agriculture, also representing the Soil Conservation Service; along with designated representatives of the Economic Research Service and the U. S. Forest Service. Subsequent review and approval of these actions were given by the U. S. Department of Agriculture Advisory Committee in Washington.

As needed, informal meetings and discussions between representatives of these agencies were held for the exchange of information and data with concurrence of the Field Advisory Committee as deemed necessary. No attempt was made by the U. S. Department of Agriculture to reconcile differences in data derived from different sources. Such reconciliation was handled by the Commission.

Coordination

Coordination of the studies was accomplished mainly by informal liaison between the agencies doing work for the Commission. A significant start was made in coordination when the work plan was prepared and reviewed and discussed with staff members of agencies that later undertook the work. The Commission served as the focal point for the coordination activities although in later phases of the studies the agency representatives worked directly together. Also within the Department of Agriculture, the Field Committee, which included representatives of the main agencies within the Department doing work for the Commission, contributed to the effort of coordination.

The committee of specialists referred to earlier

in the discussion of work plans, accomplished some coordination of studies through a series of meetings. Continuing contact was retained with the members of the committee, but formal meetings were not held after the work plans were prepared.

In addition, the advisory groups, known as the Land, Water, and Economics Groups, rendered advice and comments. These groups were organized for such purposes as the technical review of preliminary basin reports, including drainage and irrigation reports, and for review and comments on other information developed. As an incidental associated activity, these groups served as a media for disseminating study results to the Federal and State agencies concerned primarily with land and water resource development.

Findings

Inventory - Irrigation

A summary of the significant 1960 irrigation inventory data for the study area follows: about 110,000 acres were irrigated; more than 34,000 acres of tobacco and nearly 21,000 acres of vegetables were the principal crops irrigated. Following tobacco and vegetables, irrigation in descending order of magnitude occurred on pasture, corn, other field crops, orchards, grass, and hay; ponds, wells, and streams provided 66, 19, and 15 percent, respectively, of the irrigation water; of the 98,100 acre-feet of water used for irrigation, more than 73,000 acre-feet of water came from the nearly 350,000 acre-feet stored in the 33,000 farm ponds; about 6,450 of approximately 140,000 farms in the study area used irrigation and Georgia and Florida had more than 5,200 and 900 farms irrigating, respectively. South Carolina, Alabama, and North Carolina had the remaining farms irrigating, following in that order.

Of the 110,000 acres irrigated, 109,000 acres were by sprinkler method and 1,000 acres were by furrow and subsurface methods.

An inventory of the irrigable land, consisting of land best suited for cultivation: that is, in Land Classes I, II, III and IV, was computed by basins, physiographic provinces, States, Land Capability Subclasses, and land uses and acres from the Inventory of Soil and Water Conservation Needs made by U. S. Department of Agriculture with these totals:

TABLE 2.13
Irrigable Land by Basins and Land Uses - 1958
(acres)

Basin	Cropland	Pasture	Woodland	Other	Total
Savannah	978,800	396,200	1,784,900	241,700	3,401,600
Ogeechee	729,700	123,700	987,400	86,200	1,927,000
Altamaha	1,614,400	581,400	2,995,500	288,800	5,480,100
Satilla-St. Marys	337,100	97,700	1,145,700	35,100	1,615,600
Suwannee	1,487,400	330,200	2,103,900	186,300	4,107,800
Ochlockonnee	533,600	132,100	998,400	88,300	1,752,400
A-C-F	2,313,000	830,300	2,707,000	590,400	6,440,700
Choctawhatchee-Perdido	1,828,000	423,500	2,827,700	250,600	5,329,800
Total	9,822,000	2,915,100	15,550,500	1,767,400	30,055,000

TABLE 2.14
Estimated Acres of Irrigable Land by Land Capability Subclass - 1958
(thousands of acres)

Land use	Land capability subclasses*										Total
	I	IIe	IIw	IIIs	IIIe	IIIw	IIIs	IVe	IVw	IVs	
Cropland	697	3,707	433	1,155	1,272	384	1,385	430	103	256	9,822
Pasture	118	814	161	175	645	160	346	365	45	86	2,915
Woodland	223	1,756	1,106	1,013	2,313	2,361	3,073	1,948	912	846	15,551
Other	60	422	98	142	356	102	292	184	24	87	1,767
Total											30,055

* Under Land Capability Classification, subclasses are interpretive grouping of lands having similar kinds of limitations and hazards. The limitations are: e - erosion; w - wetness; s - root zone or soil limitations.

TABLE 2.15
Present and Potential Irrigation by States and Southeast River Basins
(acres)

State	Acres irrigated 1960	Potential irrigation projects	Potential ultimate irrigable acreage, project and individual onfarm (Land Classes I through IV)*
Georgia	74,977	1,183,711	17,742,000
Florida	20,338	31,630	6,600,000
South Carolina	10,448	47,060	1,400,000
Alabama	4,519	35,175	4,300,000
North Carolina	114	—	13,000
Total	110,396	1,297,576	30,055,000

* Based on Inventory of Potential Projects compiled as part of Inventory of Soil and Water Conservation Needs as of 1958 land-use conditions and other assumptions.

TABLE 2.16

**Irrigable Land in the Southeast River Basins
Area - 1958
(thousands of acres)**

Area	Irrigable land
Blue Ridge	118
Piedmont	6,660
Upper Coastal Plain	18,455
Lower Coastal Plain	4,822
Total	30,055

Inventory - Drainage

The acreages and percent of land under 1960 conditions on which the dominant problem is excess water were developed from data prepared for each county in the development of the Inventory of Soil and Water Conservation Needs, U. S. Department of Agriculture.

The significant results obtained from the inventory conducted under 1958 conditions are shown in Tables 2.17 and 2.18.

About 126,000 acres of cropland, 115,000 acres of pasture, 207,800 acres of woodland, and 29,200 acres of other land had been adequately drained as of 1960.

That portion of the entire drainage problem area which was not considered practical to drain included small local areas which cannot be drained due to soils and topography and lowlands adjacent to the Gulf of Mexico and Atlantic Ocean that are subject to periodic inundation by salt water or having brackish ground water near the surface.

The acreages by land use that require onfarm

TABLE 2.17

**"W" Soils - 1958
(acres)**

Area	"W" soils
Blue Ridge	40,100
Piedmont	1,082,300
Upper Coastal Plain	7,855,800
Lower Coastal Plain	7,635,700
Total	16,613,900

and project-type drainage, the acreage not feasible to drain by onfarm drainage facilities, and the extent to which drainage has been accomplished to date was compiled from a survey completed by field personnel of the Soil Conservation Service during the last half of the year 1960.

Table 2.19 presents a summary of acres drained and feasible for drainage in the study area.

Needs and Opportunities

From a study of the needs for agricultural production requirements shown in Appendix 9, Economics, it is concluded that the agricultural production goals established for the study area for the year 2000, which represents a reasonable portion of the food and fiber requirements of the Nation, could be substantially met with accelerated resource development through application of proven improvements in technology and such changes in land use as might readily be made by landowners at reasonable conversion and crop production costs. From a viewpoint of regional agricultural production alone, there is no apparent urgent reason to promote large scale irrigation or drainage projects in the study

TABLE 2.18

**Acreages Where Excess Water Is the Dominant Hazard - 1958
(thousands of acres)**

Basin	Cropland	Pasture	Woodland	Other	Total
Savannah	110.0	69.1	849.3	32.4	1,060.8
Ogeechee	66.8	20.9	1,188.1	178.1	1,453.9
Altamaha	104.8	71.4	2,157.3	89.2	2,422.7
Satilla-St. Marys	147.8	54.0	2,099.8	182.1	2,483.7
Suwannee	104.5	86.5	2,938.5	71.0	3,200.5
Ochlockonee	24.4	19.4	1,249.7	54.5	1,348.0
A-C-F	157.4	149.6	2,019.5	132.7	2,459.2
Choctawhatchee-Perdido	56.3	94.6	1,969.3	64.9	2,185.1
Total	772.0	565.5	14,471.5	804.9	16,613.9

TABLE 2.19
Summary of Acres Drained and Feasible for Drainage - 1960
(acres)

Basin	Adequately drained	Feasible for group drainage	Feasible for onfarm drainage
Savannah	46,200	402,000	613,000
Ogeechee	29,000	760,600	664,400
Altamaha	39,900	1,146,100	1,236,500
Satilla-St. Marys	110,000	1,406,100	967,600
Suwannee	58,900	1,415,500	1,726,200
Ochlockonee	25,300	611,600	711,200
A-C-F	102,300	1,120,100	1,236,200
Choctawhatchee-Perdido	66,400	995,900	1,122,900
Total	478,000	7,857,900	8,278,000

area. This should not be strictly interpreted to mean that new irrigation and drainage developments will not, or should not, be installed in the area in the future.

Expansion of irrigation will take place whenever it is the best enterprise alternative to improving farm efficiency considering the inherent opportunities for expanding the efficiency of existing and future farm operations, for attaining income stabilization benefits and for continuing the general conservation movement. Data compiled by U. S. Department of Agriculture indicate that, in portions of the study area on certain soil groups and for crops, such as tobacco and vegetables, a sizable increase in net farm income per acre can be achieved through irrigation.

The trend in land drainage based on local enterprise needs will continue and will necessitate offsetting adjustments in crop production in other less productive or higher cost areas within the Southeast River Basins. Possibly of greater importance is that increased net annual farm income, which can be realized through drainage, is estimated to exceed annual costs of improvements by a very sizable margin.

Under the above circumstances, some agricultural interests will prefer irrigation and drainage improvements over alternative land-use changes and other inputs, where opportunities exist, and it is to their economic advantage. Therefore, in developing needs for irrigation and drainage improvements the major premise on which the improvements are projected were substantially based on the above assumptions.

In many areas, particularly the lower central portion of the Southeast River Basins area, unexploited ground water underlies a significant area of irrigable land. Most of the irrigation can be accomplished by individual onfarm systems, although in some places it is possible to develop surface water supplies by multiple-purpose projects at nominal costs. In other areas it may be expected that developments and use for municipal and industrial purposes will make available return flow waters in sufficient quality and quantity to provide a dependable supply of water for irrigation. In the instance of industrial water supply development, organic pollution in the return flows may be such as to preclude the use of the water for irrigation of crops such as vegetables.

Considering land with suitable physical properties, but without consideration of the availability or cost of water under conditions expected to exist in 1975, more than 12,507,000 acres of land adapted to cropland and pasture could be irrigated. Competition for land and other economic considerations will probably limit the cropland and pasture acreage under 2000 conditions to about 12,249,000 acres that could be irrigated.

Estimates based solely on annual increasing trends in irrigation from 1954 and the potential available water supply indicate that 367,900 acres of cropland and pasture probably would be irrigated in 1975 and more than 718,000 acres in 2000.

The amount of profitable irrigation expected

TABLE 2.20
Estimated Irrigated Land—Basis of Trends
 (thousands of acres)

Basin	Total acres that can be irrigated by project and onfarm		Total acres that can be irrigated on individual farm basis		Total acres that probably will be irrigated on individual farm basis based solely on trends from 1954	
	1975	2000	1975	2000	1975	2000
Savannah						
Cropland	937.7	836.8	345.6	305.4	32.6	71.6
Pasture	611.4	645.9	233.3	243.7	14.0	30.7
Ogeechee						
Cropland	683.0	651.1	550.1	528.3	33.6	76.1
Pasture	203.4	261.4	171.0	211.2	1.3	3.3
Altamaha						
Cropland	1,176.9	1,028.5	330.0	292.2	49.7	108.8
Pasture	945.6	1,004.7	243.9	263.2	13.0	28.3
Satilla-St. Marys						
Cropland	287.1	281.3	93.5	91.7	34.9	53.2
Pasture	163.1	187.4	53.1	61.0	3.3	5.1
Suwannee						
Cropland	1,027.2	945.3	556.3	511.4	68.8	96.8
Pasture	536.9	593.9	297.3	283.6	13.2	19.8
Ochlockonee						
Cropland	430.2	402.8	163.7	155.4	22.2	45.6
Pasture	247.0	264.9	110.6	116.4	5.5	12.2
A-C-F						
Cropland	1,748.4	1,581.2	843.0	771.8	44.3	96.8
Pasture	1,544.3	1,631.5	663.7	709.3	18.7	41.0
Choctawhatchee-Perdido						
Cropland	1,169.7	1,041.0	451.3	401.8	10.3	22.5
Pasture	795.4	891.7	307.0	344.2	3.0	6.6
Total						
Cropland	7,460.2	6,768.0	3,833.5	3,058.0	295.9	571.4
Pasture	5,047.1	5,481.4	2,079.9	2,232.6	72.0	147.0

to be accomplished is anticipated to be much less than the trends indicate. The plan for irrigation is based on selected crops on specific soil groups and is in addition to the acreage irrigated in 1960. During the period from 1960-75 about 102,100 more acres and from 1976-2000 about 107,200 more acres are expected to be irrigated mainly by use of individual farm systems.

In view of the generally ample water available, no irrigation water supply problems are foreseen. Sprinkler irrigation systems are expected to continue to be the major method of irrigation.

From information based on trends, farmer interest, and the present program rate of establish-

ment and other criteria, the following acreages of "w" types soils will be drained by open channels through small groups and by individuals between 1960 and 2000:

	1960-75	1976-2000
Cropland	44,600	73,500
Pasture	26,900	74,400
Other	25,800	37,000

Acres of woodland water control expected to be installed are contained in Forest Conservation and Utilization, Section VII.

TABLE 2.21
Summary of Irrigation and Drainage Benefits and Costs
(thousands of dollars)

Development	Benefits Annual equivalent	Costs			Investment
		Annual equivalent	OM&R ¹	Total	
Irrigation					
Ogeechee					
Individual	893	70	443	513	1,953
Satilla-St.Marys ²					
Projects-Georgia					
Big Satilla Creek	3	0.9	0.1	1	30
Axson	3	0.9	0.1	1	20
Upper Hurricane	11	0.8	0.2	1	30
Individual					
Florida	196	19	97	116	533
Georgia	1,772	153	776	929	4,247
Suwannee ²					
Projects-Georgia					
Tifton	1	1	--	1	17
Hixtown	1	1	--	1	20
Moultrie	1	1	--	1	15
Mud Swamp	1	1	--	1	14
Quitman	1	1	--	1	14
Nashville	1	--	--	--	8
Shiloh	2	1	--	1	24
Ashburn	1	1	--	1	12
Alapaha	2	1	1	2	40
Individual					
Georgia	3,435	187	942	1,129	5,178
Florida	1,576	86	433	520	2,382
Ochlockonee					
Individual					
Georgia	976	77.2	382.8	460	2,120
Florida	479	37.3	187.7	225	1,040
Choctawhatchee-Perdido					
Individual					
Alabama	454	37	177	214	1,035
Florida	104	8	38	46	223
Savannah					
Individual					
South Carolina	268.8	32.1	198.4	230.5	889
Georgia	317.0	37.9	234.0	271.9	1,048
North Carolina	2.4	0.3	1.7	2.0	8
Apalachicola-Chattahoochee-Flint					
Individual					
Georgia	634	63.6	378	441.6	1,760
Florida	74	7.4	43.9	51.3	204
Alabama	139	13.9	82.8	96.7	385
Altamaha					
Individual	3,614	221	1,399	1,620	6,113
Drainage					
Ogeechee					
Upstream watershed	92.6	37.3	8.7	46.0	1,031
Individual	874.0	22.0	42.0	65.0	619

(continued)

TABLE 2.21—Continued

Development	Benefits Annual equivalent	Costs			Investment
		Investment	Annual equivalent OM&R ¹	Total	
Satilla-St. Marys					
Upstream watershed					
Georgia	390	156	52	208	4,306
Florida	1,181	154	45	199	4,214
Individual					
Georgia	520	8.1	17.2	25.3	223
Florida	60	1.2	2.5	3.7	33
Suwannee					
Upstream watershed					
Georgia	70	28	8	36	766
Florida	780	160	48	208	4,439
Individual					
Georgia	565	12	12	24	341
Florida	290	7	6	13	193
Ochlockonee					
Upstream watershed					
Georgia	65.6	14	3	17	389
Florida	453.0	270.5	75.4	345.9	7,496
Individual					
Georgia	33	1.1	1.9	3.0	29
Florida	19	0.6	1.4	2.0	21
Projects-Florida					
Gulf Coast Improvement	90	77.2	8.8	86	2,140
Choctawhatchee-Perdido					
Upstream watershed					
Alabama	--	--	--	--	--
Florida	63	70	29	99	961
Individual					
Alabama	109	5	10	15	143
Florida	32	2	6	8	45
Savannah					
Upstream watershed					
South Carolina	--	--	--	--	--
Georgia	73	27	10	37	879
Individual					
North Carolina	1.6	0.1	0.2	0.3	3
South Carolina	127.5	6.7	12.7	19.4	185
Georgia	155.1	8.3	15.7	24.0	229
Apalachicola-Chattahoochee-Flint					
Upstream watershed					
Alabama	--	--	--	--	--
Florida	--	--	--	--	--
Georgia	1,700	167	91	258	5,600
Individual					
Alabama	92	3.9	7.4	11.3	108
Florida	47	1.8	3.5	5.3	50
Georgia	405	15.9	30.2	46.1	441
Altamaha					
Upstream watershed	12	4.0	1.6	5.6	143
Individual watershed	123	5.0	9.0	14.0	131
Townsend	142	42.0	28.0	70.0	1,180

NOTES: ¹ Operation, maintenance, and replacements costs at year 2000 are assumed to be equal to the annual equivalent operation, maintenance, and replacements costs.

² Includes allocated storage costs and benefits assigned to irrigation water supply.

Alternatives

There are alternative uses for wetlands, including use for production of wood products and as wildlife habitat. Forestry and fish and wildlife significance of these wetlands is discussed in the Sections on Forest Conservation and Utilization and Fish and Wildlife. Other interrelationships are brought out in the Section on specific projects. It is not intended to imply that resource development by drainage of wetlands for agricultural purposes is necessarily more desirable than other uses or improvements. All alternative uses should be given appropriate consideration by landowners and other interests concerned before specific plans are developed.

An alternative plan for drainage improvement involves the accelerated use of tile drain in lieu of open channels. This would result in higher total installation costs. This alternative is based on the assumption that more land will be used for producing specialty crops and vegetables with the result that farmer interest in the use of tile drains will increase. This alternative applied to the same amount of land expected to be drained would show an increase in the degree of drainage applied to the areas converted to specialty crops and vegetables. For the purposes of this alternative, it is estimated that about 495 miles of tile drains would be installed on 7,425 acres of cropland between 1960 and 1975 and 890 miles on 13,350 acres between 1976 and 2000. This would increase the farmer costs between 1960 and 1975 by an estimated \$1,059,300 and increase the costs between 1976 and 2000 by an estimated \$3,920,850. Other alternative plans which might be considered would essentially involve a change in the acres drained with proportionate changes in costs.

In lieu of the individual onfarm systems of irrigation expected to be used, an alternative plan for irrigation would essentially involve a change in the areas irrigated. Basic values of costs, water supply, and other parameters are readily available for determining modifications in irrigated acreage.

Based on studies made, it is not expected that project action solely for irrigation will be needed in the foreseeable future. It is considered probable that project action storing water for irrigation may be included as a multiple-purpose function of floodwater retarding or other types of

impounding structures. If project irrigation were used, 195 potential projects could provide water for irrigation on 1,297,500 acres by the year 2000. The local people cannot adequately defray these project costs. Action through local units of government, such as soil and water conservation districts, irrigation districts, or other organizations, and aid from State and Federal agencies may be needed to help install the irrigation projects.

Comprehensive Plan

The formulation of the comprehensive basin plans involved taking cognizance of the overall needs for food and fiber and the role that irrigation and drainage could play toward meeting these needs.

Illustrating the principal difficulties encountered in developing the comprehensive plan are the following six examples:

(1) Agricultural production from the study area from 1960 to 2000 without new drainage and irrigation developments must make allowance for the expected withdrawal of agricultural lands to be used for urban, special, and other uses and for a population increase of from 4,948,000 people in 1960 to 10,052,200. Non-agricultural uses of land of about 4,488,000 acres in 1959 would increase to about 6,167,000 acres in 2000. Under these assumptions, it was difficult to separate the agricultural production which may come from drainage and irrigation from technological developments such as improved and intensified fertilizer usage, application of soil and water conservation practices and measures, improved crop varieties, insecticides, herbicides, livestock feeding efficiency improvements, chemical growth regulators, mechanization and greater managerial skills.

(2) The facts that most of the irrigable lands in the study area are in private ownership and that the costs of developing irrigation project water supplies are high in comparison with developing local onfarm water supplies caused difficulties in determining the extent of single-purpose irrigation or multiple-purpose irrigation project-type developments.

(3) As implementation of the flood damage abatement plan progresses, it may be found that some of those lands benefited will require drainage improvements in order to permit optimum

agricultural production thereon. The amount of these improvements is difficult to estimate.

(4) Cost data for irrigation and drainage has certain inherent limitations in the analysis. Cost calculations did not include some elements that may be included as circumstances warrant.

(5) Although irrigation as a practice is predicted to increase, the increase will be influenced by such variables as climate, prices, market opportunities, overall needs for more food and fiber, available water supplies, type of soil, farmer attitude, and the alternative means of getting a balanced farm operation. Estimating each of these variables is difficult; the influences of their various combinations is very difficult to estimate.

(6) Irrigation presents sharp contrasts in benefits. In dry years, benefits based on yield and quality are high; in years of high rainfall, benefits may be nil.

Components of proposed systems include reservoirs, facilities for drainage, flood control, and other purposes. The attainment of all project benefits is dependent upon continuity of project developments. This can be assured through organizations of landowners and other local interests by developing detailed plans that include financial and legal arrangements to install, manage, and maintain the improvements.

Due to adequacy of water supplies for the existing and estimated future irrigated lands, changes in streamflow, consumptive use, and depletion effect on all sources of water supply were not considered.

The release of water from existing, authorized, or newly planned reservoirs for power generation and release of other regulated flow provision were not considered. On an average annual basis the effect would be negligible in most locations.

It is not anticipated that the development of the plan for the modest amount of irrigation will have adverse effects on the navigation of any of the streams in the eight basins in the Southeast River Basins area. There appeared to be no significant conflict between the use of water for irrigation and its use for domestic, municipal, and industrial water supply due to the ample water supply; therefore, the elements were not combined. The plan for irrigation is predicated on the assumption that the land irrigated will be adequately protected from floods. The

use of water from farm ponds for irrigation in conjunction with recreation, fish, domestic water supply, and other uses is considered.

It is recognized, but not evaluated that the proposed plans for drainage of wetlands would be beneficial from the standpoint of mosquito control, other disease vectors, and pest species.

It is assumed that, on lands to be irrigated, necessary drainage will be provided either before irrigation development occurs or during the development process.

Studies by the land-grant colleges, the U. S. Department of Agriculture agencies, and the U. S. Geological Survey were conducted to obtain the necessary additional information to assist the Study Commission staff with the preparation of comprehensive plans.

Phasing or scheduling of drainage projects in general is based primarily on their economic feasibility, urgency of need, and opportunity for development, but specific project location was based partly on local interest.

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

U. S. Department of Agriculture:

Technical Memoranda and Supplements, Drainage and Reclamation, for following basins as dated: Savannah, April 1961; Ogeechee, February 1961; Altamaha, May 1961; Satilla-St. Marys, February 1961; Suwannee, March 1961; Ochlockonee, March 1961; Apalachicola-Chattahoochee-Flint, May 1961; and Choctawhatchee-Perdido, March 1961; Soil Conservation Service.

The Drainage and Reclamation Technical Memoranda contains a summary of inventory of drainage problems, shows the acreage of land uses on which the dominant problem is excess water; describes present drainage conditions by physiographic regions in the basins; indicates the types of adverse drainage conditions; inventories acreage drained and feasible to drain, forecasts future needs and acreage needing drainage to the years 1975 and 2000, and describes potential drainage projects for the individual basins in the study area. The Irrigation Technical Memoranda contains, by basins, an inventory of 1960 irrigation development and water supply, estimates water requirements for the projected irrigation needs by the years 1975 and 2000, describes potential for irrigation project development, and contains 16 tables on various aspects of irrigation.

Production Data on Individual Drainage Systems and Production and Gross Returns for Irrigation; Tables, for following basins as dated: Savannah, December 1, 1961; Ogeechee, September 1961; Altamaha, January 1, 1962; Satilla-St. Marys, October 9, 1961; Suwannee, October 9, 1961; Ochlockonee, November 13, 1961; Apalachicola-Chattahoochee-Flint, January 2, 1962; and Choctawhatchee-

Perdido, October 1961; Soil Conservation Service.

Total Production Without and With Accelerated Program, Farm Economics Division, Economic Research Service.

Consists of two pages of explanatory material and attached tables, by basins, with acreages of crops and pasture for drainage, flood control, irrigation, and drainage combined with flood control, 1975 and 2000.

Estimated Residual Net Returns to Irrigation Management, and Maximum Resource Investment Amounts for Irrigation, Flood Control and Drainage, Farm Economics Division, Economic Research Service, October 30, 1961, and November 27, 1961.

Consists of three pages of descriptive material with tables attached on eight basins in the Southeast River Basins study area.

Soil Groupings for Crop Yield Estimates in the Southeast River Basins, Soil Conservation Service, June 1961.

Classifies soils found in the study area into 45 groups and according to occurrence of the soils as found in Blue Ridge, Piedmont, and Coastal Plain provinces. Each soil group is described and soil series, types, and phases by soil numbers for each soil group by province within the study area is listed.

U. S. Geological Survey. *Hydrologic Characteristics of the Southeast River Basins*, U. S. Geological Survey, 1960.

Contents of this document are described in Appendix 10, Hydrology.

Other references used:

U. S. Congress, Senate. *Water Resources Activities in the United States*, Committee Print Numbers 1 — Water Facts and Problems; 2 — Reviews of National Water Resources During the Past 50 years; 3 — National Water Resources and Problems; 4 — Surface Water Resources of the United States; 12 — Land and Water Potentials and Future Requirements for Water; 13 — Estimated Water Requirements for Agricultural Purposes and Their Effects on Water Supplies; 17 — Water Recreation Needs in the United States, 1960-2000; and 31 — The Impact of New Techniques on Integrated Multiple-Purpose Water Development. Select Committee on National Water Resources, Washington: U. S. Government Printing Office, 1960.

U. S. Department of Agriculture. *Conservation Irrigation in Humid Areas*, Agriculture Handbook No. 107, Soil Conservation Service, Government Printing Office, January 1957.

This 52-page handbook describes conservation irrigation farming as regards needs, benefits, costs, requirements and planning of irrigation systems, water use and water supplies and types of systems.

Supplemental Data

Work plans for irrigation and drainage and reclamation follow. Other supporting details on irrigation and drainage are in the files of the Commission.

WORK PLAN — IRRIGATION

(edited to delete administrative details)

I. General — The 85th U. S. Congress enacted PL 85-850 for the purpose of providing for an integrated and

cooperative investigation, study and survey of certain river basins in four Southeastern States. This is to be accomplished in the study area for several purposes, including, "irrigation."

"Irrigation" is defined as the artificial and efficient application of water under a planned system in accordance with such factors as needs of the crop, the characteristics of the soil and topography by means of perforated pipes or nozzles, by surface and sub-surface systems. Irrigation water is considered as that applied to provide moisture for plants during periods of rainfall deficiency and under certain conditions to increase yields. The irrigation phase of the study will present a plan for the development of the irrigation potential within the study area.

II. Purpose — The principal purpose of the irrigation phase of the study is to integrate that subject into a basic and comprehensive plan for the conservation, utilization and development of the land and water resources of the designated study area.

III. Guidelines — A comprehensive outline will be prepared of the past and present irrigation development and future irrigation potentials in the Southeast River Basins, including the types of irrigation facilities from all sources of water. The potential of irrigation development will be outlined. This will be done in terms of how irrigation will contribute to more efficient use of the natural resources of the area to help provide a sound basin-wide and national economy.

Another objective will be to determine lands suitable for irrigation, including the interrelationship between irrigation and other major water use and control aspects. The quantity and quality of water available for irrigation will be estimated.

Water management practices now used and expected to be needed to achieve distribution and use of irrigation waters without waste or erosion and related factors, will be estimated.

Existing and projected requirements for technical, financial and other services related to irrigation will be considered. Estimates may be included which will indicate needs for additional legislative, research and educational programs and facilities.

Irrigation is of necessity closely related to data on available water supply, other water use requirements, basin economics, financial studies, etc. Data on these subjects may be found in other outlines. Particular reference is made to the following outlines.

- Drainage and Reclamation
- Soil Conservation and Utilization
- Municipal and Industrial Water Supply
- Flood Control
- Water Storage Reservoir Capacities
- Hydroelectric Power
- Sediment Control

In addition to the above subjects additional outlines may be developed which will be related to irrigation.

IV. Work Outline

A. Definitions, planning criteria, standards

(This data to be performed by staff member and/or irrigation sub-work group.)

B. Basic Data

1. Inventory of existing programs, facilities and problems
 - a. Inventory of presently irrigable lands (USDA and Table 49)
 1. By soil and crop
 2. By location
 - b. Kinds of irrigation systems in use (USDA)
 1. Sprinkler
 2. Surface
 3. Sub-surface
 4. Kind of power
 - c. Water presently used for irrigation (USDA and Table 50)
 1. Diverted from streams
 2. Stored in reservoirs
 3. Ground water
 4. Water quality
 - d. Inventory of lands economically suitable for irrigation (USDA)
 1. By soil and crop
 2. By location
 3. By accessibility of water supply
 - a. Pumping lifts
 - b. Storage
 - c. Diversion
 - d. Horizontal pumping distances
 4. By method of irrigation
 - a. Lands requiring leveling
 - b. Lands not requiring leveling
 - e. Study of conservation and water efficiency use practices (Sub-work group)
 - f. Estimate optimum present production without irrigation
 1. Cropland (ARS, SCS, ES)
 2. Grassland (ARS, SCS, ES)
 3. Forest (USFS, State Forest Agencies)
 - g. Number of farms irrigating and acreage irrigated and list of irrigation practices and measures now in use and units of measurement (Sub-work group and table 48)
 - h. Water right laws and irrigation district legal organizations (Sub-work group)
 - i. List existing irrigation activities of:
 1. SC Districts
 2. FHA
 3. ES
 4. SCS
 5. ARS
 6. List others
 2. Analysis of above basic data (Sub-work group and USSC staff member)
 3. Need for irrigation development at least to the years 1975 and 2000 (USDA)
 - a. Relation of irrigation crop and pasture production to total needs
 - b. Available irrigable lands
 1. Modification due to encroachment, other uses, etc.

¹ Obtain this information from the respective agencies.

c. Potential production by sources

- d. Needed water supplies (USGS, ARS, SCS)
 1. Surface
 2. Ground water
 3. Additional supply for (a) presently irrigated areas and (b) new areas
- e. Inventory agricultural water management – irrigation project needs at least to the years 1975² and 2000
 1. Acreage having the problem
 2. Acreage needing project action
 3. Number of farms that have some acreage age included in item 2
- f. Determine acreage to be irrigated and located where possible by counties, sub-basins, states and study area at least to the years 1975 and 2000 (ARS, SCS, ES)
- g. Determine needs for improving existing irrigation facilities (SCS, ARS)
- h. Needed practices and measures to efficiently utilize and manage soil and water resources (SCS, ARS)
 1. Soil conservation practices
 2. Water conservation practices
 3. Other technological improvements
- i. Determine data on: (USGS, SCS, ARS)
 1. Consumptive use by irrigated crops
 2. Effectiveness of rainfall on a frequency basis under irrigated conditions
 3. Irrigation water requirements on a frequency basis
- j. Water supplies to meet future needs
 1. Ground water (USGS)
 2. Storage (SCS, C of E)
 3. Diversion (C of E, SCS)
 4. Salt water conversion
- k. Distribution and storage systems required to meet the needs (Sub-work group)
- l. Water rights and allocation problems in meeting needs (Sub-work group)
- m. Institutional arrangements
 1. Group enterprises
- n. Estimated quantities of irrigation measures and practices to meet needs by the years 1975 and 2000
- o. Estimated quantities of irrigation measures and practices that can be installed by present programs by the years 1975 and 2000
- p. Estimated annual costs of present programs
4. Develop an irrigation program, through the years 1975 and 2000
 - a. Single-purpose plan³
 1. Estimated installation cost of the recommended single-purpose plan

² Obtain data from SCS for 3e (1, 2, and 3) from, "Conservation Needs Inventory."

³ Single-purpose plan will present an idealistic basis of meeting the needs for resource development for irrigation without consideration to the other functions or purposes mentioned in Section 1a of Public Law 85-850.

2. Estimated annual operating and maintenance cost of the single-purpose plan
3. Analyze and evaluate feasibility of single-purpose plan
4. Compatability with other purposes in comprehensive plan
- b. Modified single-purpose plan
- c. List the legislative, research or other means for implementing the modified single-purpose plan
5. Develop list of technical memoranda needed in accordance with above tasks

C. Technical Programming (Administrative details)

WORK PLAN - DRAINAGE AND RECLAMATION

(revised January 8, 1960)

I. General — The 85th U. S. Congress enacted P.L. 85-850 for the purpose of providing for an integrated and cooperative investigation, study and survey of certain river basins in four Southeastern States. This is to be accomplished in the area for several purposes, including "drainage and reclamation."

"Drainage," as used in the Act is considered to mean the removal or control of excess water from, on, or within the soil by means of surface or subsurface drains or by means of engineering works.

The sources of excess water may be precipitation on the area, irrigation waste, overland flow or underground seepage from adjacent areas, artesian flow from deep aquifers, flood water from channels, or water applied for such special purposes as leaching salts from the soil or for temperature control.

"Reclamation," is considered as restoration or conversion of lands to more favorable use for wildlife, cropland or other purposes.

Problems and measures concerning conservation on drained lands will be considered under the function, "Soil Conservation and Utilization."

Measures for the prevention of overflow by all facilities such as levees will be considered under the Flood Control Study.

II. Purpose — The principal purpose of the drainage and reclamation phase of the study is to integrate that subject into a basic and comprehensive plan for the conservation, utilization and development of the land and water resources of the designated Southeast River Basins. It is expected that the final plan will be the instrument whereby the several purposes will be integrated so that each function will participate to the maximum extent.

Studies which will precede the final plan will be directed toward the development of a single-purpose plan for drainage and reclamation. Most likely the single-purpose plan will be modified when the other functions mentioned in the Act are included in the final plan.

III. Guidelines — It is proposed that units of measurement and definitions associated with drainage and reclamation will be developed.

Drainage and reclamation problems and conditions will be inventoried, as will existing facilities and activities.

Future drainage and reclamation needs will be estimated. If needed, additional facilities and activities will be listed. These may be either group or non-group needs.

After the above mentioned needs and other determinations have been made, a single-purpose plan will be developed. This plan will contain certain projections at least to the years 1975 and 2000. In developing the plan, present programs, facilities and potentials of such programs and facilities will be considered. In addition, estimates will be made of costs of operation and maintenance of facilities and programs.

Feasibility determinations will be made of the single-purpose plan. If it is indicated that legislative, educational and related problems will occur, recommendations will be made in the modified plan that may resolve the problems. This will be needed particularly if implementation of the plan will be effected.

A sub-work group will be organized for the purpose of assisting in the preparation of detailed work plans, in the compilation and analysis of basic data and in the preparation of technical memoranda. The sub-work group will be composed of representatives of agencies involved in drainage and reclamation activities and consultants as the latter are considered to be contributors to the formulation of the plan.

IV. Work Outline

A. Develop definitions, planning criteria and standards.

(To be performed by staff members and/or sub-work groups)

B. Technical tasks

I. Basic Data

a. Inventory of drainage and reclamation problems and conditions

1. Land on which the dominant problem is excess water¹ (SCS)

- a. By acres
- b. Location and extent

2. Types of adverse drainage conditions

a. Causes, location and extent of

1. Undeveloped natural drains (SCS)

2. Lack of adequate drainage systems (C of E, SCS)

3. Unsatisfactory soil characteristics (SCS)

4. Clogging of natural and artificial drains as a result of vegetative growth and siltation (C of E, State agencies)

5. Blocking or constriction of natural and artificial drains by such structures as culverts, bridges, dams, railroad and highway fills, urban and suburban developments, etc. (State Highway Depts., USDA, CE)

6. Reduced effectiveness of major streams as drainage outlets because of sedimentation (USGS, CE, SCS)

¹ Parts of the "National Inventory of Soil and Water Conservation Needs" for the states involved and projections will be used to the maximum extent possible in developing basic data on these items.

7. Problems connected with irrigation (USDA)
2. Inventory of existing drainage and reclamation facilities and activities
 - a. Land adequately treated or treatment not feasible¹ (SC)
 1. By acres
 2. Location and extent
 - b. Existing drainage facilities of all types (USDA)
 1. Location
 - a. Current status and activities
 - c. Current drainage and reclamation practices (USDA, C of E)
 1. Farm practices
 2. Main channel, structure types, etc.
 3. Determine and forecast future needs for drainage and reclamation, years 1975 and 2000
 - a. Relation of drainage and reclamation to future crop needs (colleges)
 - b. Impact of drainage and reclamation on meeting needs by increasing potential production (colleges)
 - c. Acres needing treatment and feasible to treat (includes cropland, pasture and range, forest and woodland, "other land" and certain watershed protection needs)¹ (SCS)
 - d. Location and extent (C of E, USDA)
 1. Major group drainage projects
 2. Lands needing drainage or reclamation (non-group, or project)
 - a. Tidal lands
 - b. River bottoms or flood plain problems
 - c. Ponded bays or areas
 4. Describe drainage and reclamation facilities needed (C of E, USDA)
 - a. By types and units
 - b. Determine and forecast quantities of drainage

¹ Parts of the "National Inventory of Soil and Water Conservation Needs" for the states involved and projections will be used to the maximum extent possible in developing basic data on these items.

and reclamation facilities required to meet needs at least to the years 1975 and 2000. (Include improvement of existing facilities where needed and new construction)

1. Practices and structural measures needed by types and quantities to efficiently use the drained land. (Such as land leveling, pumps, levees, main canals, etc.)
- c. Estimated quantities of drainage and reclamation measures that can be installed by present programs by the years 1975 and 2000
- d. Estimated annual costs of present programs
5. Develop a drainage and reclamation program, at least to the years 1975 and 2000 by:
 - a. Single-purpose plan²
 - b. Modified single-purpose plan³
 - c. Estimated installation cost of items in the plan
 - d. Estimated annual operating and maintenance cost of the plan
 - e. Legal requirements for establishing drainage projects
 - f. Analyze and evaluate feasibility of the plan
 - g. Compatibility with other programs
 - h. Facilitating activities
 1. Consider legislative and educational problems and needs in meeting objectives
 2. Consider drainage and reclamation research needs in meeting objectives
 3. Others
6. Develop list of technical memoranda needed in accordance with above tasks.

C. Technical Programming (Administrative details)

² The single-purpose plan will present an idealistic basis of meeting the needs for resource development by drainage and reclamation without consideration of other purposes or functions mentioned in PL 85-850.

³ The modified plan will include or exclude elements because of institutional, legal, financial, physiographic, physical or other reasons so as to recognize certain inevitable factors of development.

SECTION IX – HYDROELECTRIC POWER AND INDUSTRIAL DEVELOPMENT

General Concept

Prior to the creation of the U. S. Study Commission, Southeast River Basins, the hydroelectric power potentials of the Southeast River Basins area had been studied and reported on by both the Corps of Engineers and Federal Power Commission. The private power companies and public bodies in the area had studied specific potential hydropower sites and had constructed projects at several locations.

Corps of Engineers studies of hydroelectric power projects in the upper Piedmont and Blue

Ridge provinces generally concerned generating potential. The Federal Power Commission studies parallel Corps of Engineers studies and cover additional hydropower potentials for all of the basins in the study area. Private power company studies have been mainly of the Savannah, Altamaha, and Chattahoochee River basins at and above the break between the Piedmont and Coastal Plain provinces.

The Corps of Engineers studies and investigations usually have been made to serve flood control and navigation with hydroelectric power being included where feasible. The results of

many of the studies are printed as congressional documents.

Studies previously made by the Corps and the Federal Power Commission for both single- and multiple-purpose projects were reviewed. Also, the hydroelectric potential of several additional single-purpose projects mostly in the upper Savannah basin and for all multiple-purpose developments proposed for consideration on streams in the study area basins were investigated.

The electric load of the study area and in the general southeastern electric power market area has expanded beyond the ability of hydroelectric capabilities. Most of the energy requirements of the Southeast River Basins area are now being met from steam-electric generating sources. The hydroelectric generation is generally needed for meeting peak loads of relatively short duration with a few run-of-river generating plants operating on base load. These facts were considered in evaluating the place of hydropower in the total power requirements of the Southeast River Basins.

Work Plan and Performance

A work plan for proposed studies was made in November 1959 in outline form. A power utilization study for the Southeast River Basins area and the electric power market area was made by the Federal Power Commission. In this study, the electric power supply was analyzed for existing conditions by power supply area, by class of customer in the power supply area, and source of power. Based on past growth trends and economic and social factors affecting electric load growth, a projection of electric load requirements was made by power supply areas in the Southeast Power Market area.

General physical characteristics of the existing hydroelectric power developments were listed. Among these characteristics were nameplate installation size, average annual generation, gross static head, and other pertinent data. The existing fuel electric plants were listed by operators in power supply areas giving the installed nameplate capacities which are the ratings placed on the machinery by the manufacturers.

Similar information for hydroelectric plants under construction and definitely proposed was presented. Basic data were given on potential

developments which had been reported on either by the Federal Power Commission or Corps of Engineers. The study furnished at-site values for hydroelectric power and general costs for transmission systems.

As part of the work plans for other functions, the Corps of Engineers furnished pertinent basic data and characteristics of projects studied or investigated by the Corps.

The Georgia Power Company and Alabama Power Company estimated the 1959 electric energy sales by their respective companies by basin areas. The Federal Power Commission electric load data and basin data furnished by the power companies were used to make electric load and power studies for each basin. To help in this study, historical load data for the electric membership cooperatives in the Southeast River Basins area was analyzed by class of customer and by customer usage. A like analysis was made for those municipalities operating their own systems within the Southeast River Basins area. From the analysis of historical data and considering factors of saturation of appliances and changes in commercial loads and industrial automation, projections were made for the target years of 1975 and 2000 for each of the eight basins in the Southeast River Basins area. These are conservatively low assumptions, but it is apparent that hydroelectric power opportunity is limited. Thus, because there will be a need for all the possible economically feasible hydro-power, these low assumptions are considered satisfactory for the purpose of this study.

The electric energy requirements thus derived were checked for compatibility against power company projections, regional values furnished by the Atlanta Regional office of the Federal Power Commission and national values presented in the U. S. Senate Select Committee Report. The projections compared favorably in all cases.

Findings

Past Power Requirements

The Southeast River Basins area is part of four power supply areas (P.S.A.) as delineated by the Federal Power Commission. That part of the study area in North and South Carolina is in power supply area 21. The Georgia part of the study area is in power supply area 23.

Power supply area 22 covers the Alabama part of the study area and that part of Florida west of the Apalachicola River except for an area around Port St. Joe. The rest of Florida in the study area is in power supply area 24. These four power supply areas referred to as the power market area comprise a larger area than that of the Southeast River Basins area.

Past Power Requirements in Market Area

Table 2.22 shows the past power requirements for the market area and each power supply area.

Table 2.23 shows the past power requirements for the study area and the basins within the study area.

Power Capacity in Market Area

The sources of power in the market area and in the study area are made up of steam-electric, hydroelectric, and internal-combustion generating plants. Gas-turbine generating units have recently been added at two steam-electric plants. One of these units is in the study area. Also, nuclear-power electric generating plants are un-

der construction at two locations in the market area outside the study area. These nuclear-powered plants, 19,000 kilowatts in South Carolina and 50,000 kilowatts in Florida, are being constructed primarily for development purposes and operation experience.

The installed capacity in the market area on December 31, 1958, exclusive of capacity not contributing to the public supply, totaled 12,881,476 kilowatts. Of this total, 10,214,461 kilowatts, or about 79 percent, were installed in fuel-electric plants and 2,667,015 kilowatts, or 21 percent, were installed in hydroelectric plants. Table 2.24 gives the installed capacity by type of generating plant and by class of ownership.

Power Generation in Market Area - 1958

During the year 1958 the facilities listed in Table 2.24 generated a total of 58,076 million kilowatt-hours of electric energy. This included 48,626 million kilowatt-hours, or about 84 percent, produced by fuel-electric plants and 9,450 million kilowatt-hours, or about 16 percent, produced by hydroelectric plants. Production for

TABLE 2.22
Past Power Requirements - All Utility Systems*

Item	Year				
	1940	1945	1950	1955	1958
Power supply area 21					
Energy for load (million kw.-hr.)	5,215	7,139	12,282	19,560	22,925
Annual maximum demand (thousand kw.)	1,064	1,849	2,438	3,597	4,273
Annual load factor (percent)	56.0	60.4	57.5	62.1	61.2
Power supply area 22					
Energy for load (million kw.-hr.)	2,369	3,790	5,663	8,778	11,366
Annual maximum demand (thousand kw.)	449	674	1,076	1,640	2,159
Annual load factor (percent)	60.2	64.2	60.1	61.1	60.1
Power supply area 23					
Energy for load (million kw.-hr.)	2,374	3,699	5,790	9,092	11,502
Annual maximum demand (thousand kw.)	497	671	1,179	1,733	2,297
Annual load factor (percent)	54.5	62.9	56.1	59.9	57.2
Power supply area 24					
Energy for load (million kw.-hr.)	1,279	2,297	4,384	8,441	13,125
Annual maximum demand (thousand kw.)	312	456	1,041	1,847	2,707
Annual load factor (percent)	46.8	57.5	48.1	52.2	55.3
Market area					
Energy for load (million kw.-hr.)	11,237	16,925	28,119	45,871	58,918
Annual maximum demand (thousand kw.)	2,322	3,150	5,734	8,817	10,981
Annual load factor (percent)	55.2	61.3	56.0	59.4	61.2

* Includes imports of energy from outside the market area.

TABLE 2.23
Past Power Requirements of All Distribution Systems in Southeast River Basins

Basins	1952	1956	1959
Savannah			
EMC* (million kw.-hr.)	91.2	152.7	187.7
Municipal (million kw.-hr.)	53.3	70.4	98.7
Utility (million kw.-hr.)	1,267.6	1,885.6	2,347.6
Total (million kw.-hr.)	1,412.1	2,108.7	2,634.0
Demand (thousand kw.)	283.1	414.8	504.5
Load factor (percent)	56.9	58.0	59.6
Ogeechee			
EMC* (million kw.-hr.)	22.2	35.0	53.3
Municipal (million kw.-hr.)	0	0	0
Utility (million kw.-hr.)	93.8	120.7	155.3
Total (million kw.-hr.)	116.0	155.7	208.8
Demand (thousand kw.)	31.5	39.5	51.8
Load factor (percent)	42	45	46
Altamaha			
EMC* (million kw.-hr.)	153.8	258.4	367.1
Municipal (million kw.-hr.)	57.2	81.3	106.1
Utility (million kw.-hr.)	1,546.5	2,111.4	2,721.6
Total (million kw.-hr.)	1,757.5	2,451.4	3,194.8
Demand (thousand kw.)	355.1	467.9	636.5
Load factor (percent)	56.5	59.8	57.3
Satilla-St. Marys			
EMC* (million kw.-hr.)	23.3	46.9	65.9
Municipal (million kw.-hr.)	17.7	23.2	28.5
Utility (million kw.-hr.)	321.2	446.1	584.6
Total (million kw.-hr.)	362.2	516.2	679.0
Demand (thousand kw.)	76.1	107.5	138.4
Load factor (percent)	54.3	54.8	56.0
Suwannee			
EMC* (million kw.-hr.)	74.7	129.9	178.3
Municipal (million kw.-hr.)	60.1	83.2	116.3
Utility (million kw.-hr.)	192.7	268.1	361.2
Total (million kw.-hr.)	327.5	481.1	655.8
Demand (thousand kw.)	68.0	98.3	132.0
Load factor (percent)	55.0	55.9	56.7
Ochlockonee			
EMC* (million kw.-hr.)	24.2	45.9	64.1
Municipal (million kw.-hr.)	142.8	218.5	326.1
Utility (million kw.-hr.)	34.7	51.0	72.1
Total (million kw.-hr.)	201.7	315.4	462.3
Demand (thousand kw.)	45.0	69.6	93.7
Load factor (percent)	51.2	51.7	56.9
Apalachicola-Chattahoochee-Flint			
EMC* (million kw.-hr.)	181.4	299.3	367.2
Municipal (million kw.-hr.)	326.8	474.1	653.1
Utility (million kw.-hr.)	2,396.0	3,293.2	4,268.5
Total (million kw.-hr.)	2,904.2	4,066.6	5,288.8
Demand (thousand kw.)	589.5	813.7	1,050.4
Load factor (percent)	56.2	57.0	57.5
Choctawhatchee-Perdido			
EMC* (million kw.-hr.)	115.8	191.4	255.9
Municipal (million kw.-hr.)	70.7	102.3	128.6
Utility (million kw.-hr.)	672.8	1,134.5	1,521.8
Total (million kw.-hr.)	859.3	1,428.2	1,906.3
Demand (thousand kw.)	166.3	272.6	362.1
Load factor (percent)	59.0	59.8	60.1
Southeast River Basins			
EMC* (million kw.-hr.)	686.6	1,159.5	1,539.8
Municipal (million kw.-hr.)	728.6	1,053.0	1,457.4
Utility (million kw.-hr.)	6,525.3	9,310.6	12,002.7
Total (million kw.-hr.)	7,940.5	11,523.1	14,999.0
Demand (thousand kw.)	1,614.6	2,283.9	2,969.0
Load factor (percent)	56.1	57.6	57.7

* Electric Membership Cooperatives.

TABLE 2.24
Market Area Existing Power Supply Capacity and Ownership
(kilowatts)

Location and ownership	Installed capacity of existing plants — 1958		
	Hydroelectric	Fuel-electric*	Total
Power supply area 21			
Private	1,045,562	3,862,348	4,907,910
Public — Non-Federal	155,722	210,354	366,076
Federal — Corps of Engineers	118,000	0	118,000
Total	1,319,284	4,072,702	5,391,986
Power supply area 22			
Private	473,500	1,589,980	2,063,480
Public — Non-Federal	9,120	17,308	26,428
Federal — Corps of Engineers	0	0	0
Total	482,620	1,607,288	2,089,908
Power supply area 23			
Private	417,418	1,493,900	1,911,318
Public — Non-Federal	15,200	30,500	45,700
Federal — Corps of Engineers	390,000	0	390,000
Total	822,618	1,524,400	2,347,018
Power supply area 24			
Private	12,493	2,229,218	2,241,711
Public — Non-Federal	0	780,853	780,853
Federal — Corps of Engineers	30,000	0	30,000
Total	42,493	3,010,071	3,052,564
Market area			
Private	1,948,973	9,175,446	11,124,419
Public — Non-Federal	180,042	1,089,015	1,219,057
Federal — Corps of Engineers	538,000	0	538,000
Total	2,667,015	10,214,461	12,881,476

* Approximately 1 percent of the market area total is internal combustion capacity located principally in power supply area 24.

the year by type of plant and by total power supply areas is summarized in Table 2.25.

TABLE 2.25
1958 Generation in Market Area by Type of Plant
(millions of kilowatt-hours)

Power supply area	Hydroelectric	Fuel-electric	Total
21	5,417.4	18,024.3	23,441.7
22	2,293.6	9,778.0	12,071.6
23	1,502.0	8,087.3	9,589.3
24	236.6	12,736.9	12,973.5
Total	9,449.6	48,626.5	58,076.1

Power Capacity in Southeast River Basins Area

In the study area the installed capacity on December 31, 1960, exclusive of capacity not

contributing to the public supply, totaled 2,910,700 kilowatts. Of this total, 2,043,500 kilowatts, or about 70 percent, were installed in fuel-electric plants and 867,200 kilowatts, or 30 percent, were installed in hydroelectric plants. Table 2.26 gives the installed capacity by type of generating plant and by class of ownership.

Power Generation in Southeast River Basins in 1960

During the year 1960, the facilities listed in Table 2.26 generated a total of 12,674,919,000 kilowatt-hours of electric energy. Of this total 3,163,681,000 kilowatt-hours, or about 25 percent was produced by hydroelectric plants and 9,511,238,000 kilowatt-hours, or about 75 percent,

TABLE 2.26

Southeast River Basins Area Existing Power Supply Capacity and Ownership (thousands of kilowatts)

Location and ownership	Installed capacity of existing plants — 1960		
	Hydro-electric	Fuel-electric*	Total
Power supply area 21			
Private	24.5	250.0	274.5
Public non-Federal	2.8	1.1	3.9
Federal	50.0	0	50.0
Total	77.3	251.1	328.4
Power supply area 22			
Private	0.2	231.2	231.4
Public non-Federal	9.1	39.4	48.5
Federal	0.	0	0
Total	9.3	270.6	279.9
Power supply area 23			
Private	410.6	1,269.5	1,680.1
Public non-Federal	15.2	33.0	48.2
Federal	316.0	0	316.0
Total	471.8	1,302.5	2,044.3
Power supply area 24			
Private	8.8	152.2	161.0
Public non-Federal	0	67.1	67.1
Federal	30.0	0	30.0
Total	38.8	219.3	258.1
Southeast River Basins area			
Private	444.1	1,902.9	2,347.0
Public non-Federal	27.1	140.6	167.7
Federal	396.0	0	396.0
Total	867.2	2,043.5	2,910.7

* Approximately 1.4 percent of the Southeast River Basins area total capacity is in internal combustion capacity location in power supply area 24.

was produced by fuel-electric plants. Generation for the year 1960 is shown in Table 2.27 by power supply area in the Southeast River Basins area by type of plant.

TABLE 2.27

1960 Generation in Southeast River Basins Area by Type of Plant (thousands of kilowatt-hours)

Power supply area	Hydroelectric	Fuel-electric	Total
21	284,952	1,111,391	1,396,343
22	39,903	1,265,024	1,304,927
23	2,577,643	6,480,786	9,058,429
24	261,183	654,037	915,220
Total	3,163,681	9,511,238	12,674,919

Interconnections

The power sources are connected by transmission lines to form power systems. These power systems throughout the market area are all interconnected except for a few isolated municipal or cooperative systems. Within the Southeast River Basins area all power production systems are interconnected. Figure 2.2 shows the principal electric facilities in the Southeast River Basins area and the immediate surrounding area.

Electric power and energy are exchanged among the source systems within a power supply area and among power supply areas as required to meet load requirements. Thus, the electric load demand of parts of the Southeast River Basins area may be met from sources outside the area as well as from within the area sources. Also, Southeast River Basins area sources of electric energy may meet electric load requirements in areas outside the area.

Future Power Requirements

In estimating the future electric requirements, many factors are considered. Estimates are tempered by analyses of past and present conditions and reflect a consideration of conditions expected to prevail in the future.

Market Area Requirements

In the determination of electric load estimates for the market area, consideration was given to such factors as production in large power consuming industries such as aluminum, steel, paper, and textile. Mining and manufacturing activities were considered as to their economic influence on employment and income as well as their influence on power use. Population, number of families, number of customers, saturation of electric service, uses per customer, and use per employee in industrial and commercial establishments are all factors which assist in estimating long-range electric power requirements. The estimates developed for electric power requirements are those which are considered probable of attainment in an expanding economy. All classes of ultimate consumers and factors relating to the future requirements of each class were considered.

Residential usage of electrical energy is expected to continue to increase in direct proportion to new family formation and residential

PRINCIPAL ELECTRIC FACILITIES

1961

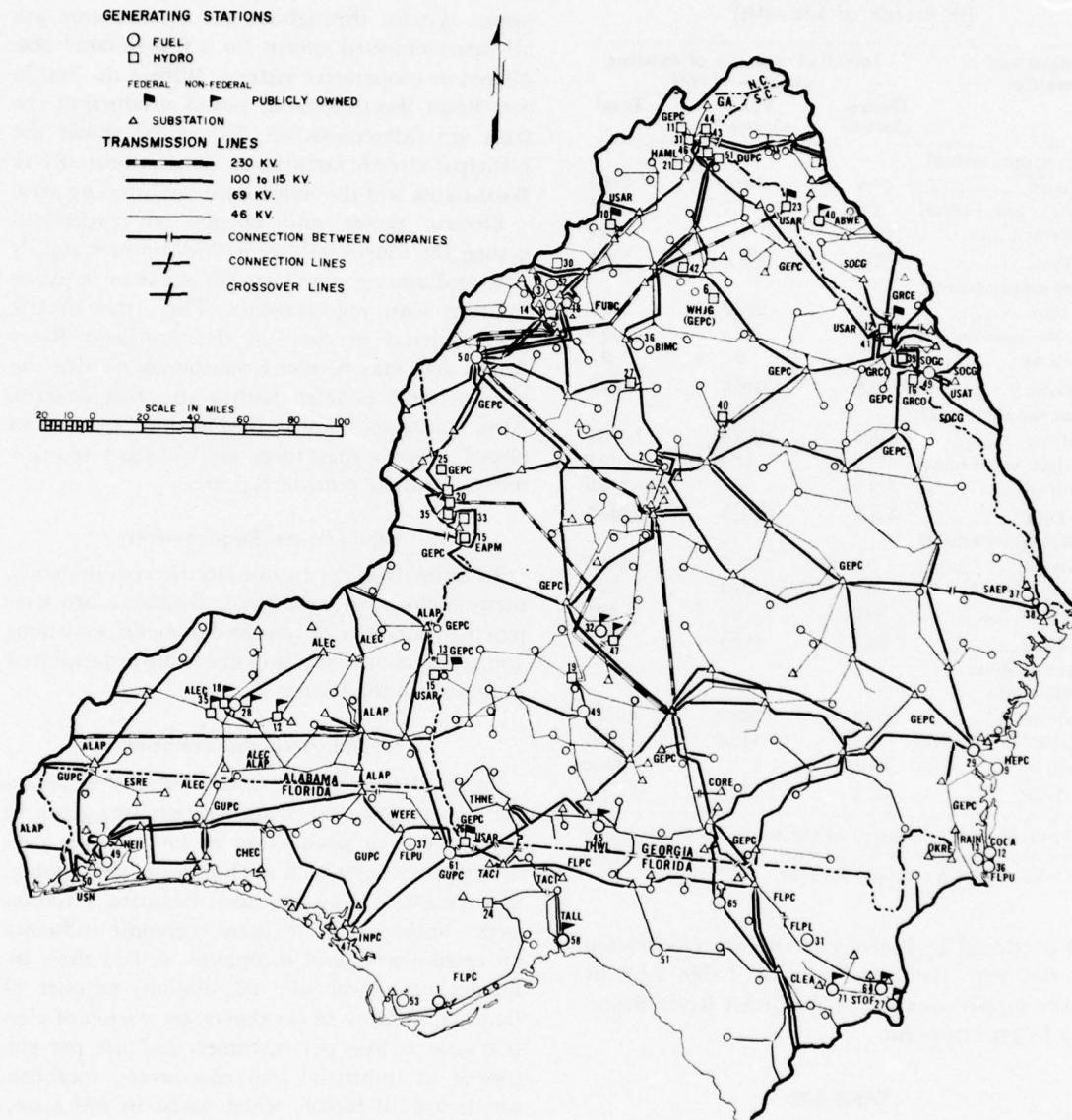


Figure 2.2

PRINCIPAL ELECTRIC FACILITIES

(Key to facilities shown on figure 2.2)

Principal Electric Facilities in Study Area

Plant No.	Name of plant	Mw Capacity and type	Utility abbreviations
ALABAMA			
12	Elba	1.5 Hy	ALEC
15	Fort Gaines	130.0 Hy	² USAR
18	Gantt	2.4 Hy	ALEC
28	McWilliams	37.0 St	ALEC
35	Point A	5.2 Hy	ALEC
FLORIDA			
1	Apalachicola	2.0 IC	FLPC
7	Crist	281.3 St	GUPC
12	Fernandina	16.5 St	COCA
13	Fernandina	13.5 St	RAIN
24	Jackson Bluff	8.8 Hy	FLPC
26	Jim Woodruff	30.0 Hy	² USAR
27	Keystone Heights	3.9 IC	CLEA
31	Lake City	1.5 IC	FLPL
36	Lime Street	9.7 IC	FLPU
		3.0 IC	FLPU
37	Marianna	1.2 IC	FLPU
47	Panama City	41.5 St	INPC
49	Pensacola	1.5 St	NEII
50	Pensacola	21.0 St	USN
51	Perry	1.0 IC	FLPC
53	Port St. Joe	40.5 St	SAJP
58	St. Marks	52.0 St	TALL
		22.0 St	TALL
61	Scholz	98.0 St	GUPC
64	Starke	6.6 IC	STOF
65	Suwannee River	133.5 St	FLPC
71	Worthington Springs	4.6 IC	CLEA
GEORGIA			
2	Arkwright	178.0 St	GEPC
3	Atkins	258.0 St	GEPC
6	Barnet Shoals	2.8 Hy	³ WHJC
7	Bartletts Ferry	65.0 Hy	GEPC
9	Brunswick	6.0 St	HEPC
10	Buford	86.0 Hy	² USAR
11	Burton	6.1 Hy	GEPC
13	Credille	1.7 Hy	³ USAR
14	Davis Street ⁴	4.0 St	GEPC
15	E and Ph. Mills	4.1 Hy	EAPM
16	Enterprise	1.2 Hy	GRCO
18	F. B. and C. Mills	8.5 St	FUBC
19	Flint River	5.4 Hy	GEPC
20	Goat Rock	26.0 Hy	GEPC
21	Habersham	1.6 Hy	HAML
23	Hartwell	1264.0 Hy	² USAR
25	Langdale	4.1 Hy	GEPC
27	Lloyd Shoals	14.4 Hy	GEPC
29	McManus	143.8 St	GEPC
30	Morgan Falls	16.8 Hy	GEPC
31	Nacoochee	4.8 Hy	GEPC
32	Crisp	12.5 St	CRCP
		5.0 GT	CRCP
33	North Highlands	29.6 Hy	GEPC
35	Oliver	60.0 Hy	GEPC
36	Porterdale	1.5 Hy	BIMC
		4.5 St	BIMC
37	Port Wentworth	104.4 St	SAEP
		St	SAEP
38	Riverside	120.0 St	SAEP
39	Sibley	2.1 Hy	GRCO
40	Sinclair Dam	45.0 Hy	GEPC
41	Stevens Creek	18.9 Hy	SOCG
43	Tallulah Falls	72.0 Hy	GEPC
44	Terrorra	16.0 Hy	GEPC
45	Thomasville	15.5 St	THWL
46	Tugalo	45.0 Hy	GEPC
47	Warwick	15.2 Hy	CRCP

Plant No.	Name of plant	Mw Capacity and type	Utility abbreviations
GEORGIA			(continued)
49	Wm. Mitchell	48.9 St	GEPC
		¹ 156.3 St	
50	Yates	680.0 St	GEPC
51	Yonah	22.5 Hy	GEPC
52	McDonough	299.2 St	GEPC
SOUTH CAROLINA			
12	Clark Hill	280.0 Hy	² USAR
40	Rocky River	2.8 Hy	ABWE
		1.1 IC	ABWE
49	Urquhart	250.0 St	SOGC

NOTES: ¹ Under construction.
² Power marketing under Southeastern Power Administration.
³ Operated by Georgia Power Company.
⁴ Recently retired.
 St - Steam, Hy - Hydro, IC - Internal Combustion, GT - Gas Turbine.

Ownership of Electric Facilities

Utility abbreviations	Type of owner	Owner
ALABAMA		
ALAP	Private	Alabama Power Company
ALEC	Cooperative	Alabama Electric Cooperative
USAR	Federal	U. S. Army
FLORIDA		
ALEC	Cooperative	Alabama Electric Cooperative
CHEC	Cooperative	Choctawhatchee Electric Coop., Inc.
CLEA	Cooperative	Clay Electric Coop., Inc.
COCA	Industrial	Container Corporation of America
ESRE	Cooperative	Escambia River Electric Coop., Inc.
FLPC	Private	Florida Power Corporation
FLPU	Private	Florida Power and Light Company
GUPC	Private	Florida Public Utilities Company
INPC	Industrial	Gulf Power Company
TACI	Cooperative	International Paper Company
NEII	Industrial	Newport Industries, Inc.
OKRE	Cooperative	Okefenokee Rural Electric Membership Corporation
RAIN	Industrial	Rayonier, Inc.
SAJP	Industrial	St. Joe Paper Company
STOF	Municipal	Starke
TACI	Cooperative	Talquin Electric Cooperative, Inc.
TALL	Municipal	Tallahassee
USAR	Federal	U. S. Army
USN	Federal	U. S. Navy
WEPE	Cooperative	West Florida Electric Cooperative Association, Inc.
GEORGIA		
BIMC	Industrial	Bibb Manufacturing Company
CORE	Cooperative	Colquitt County Rural Electric Co.
CRCP	Municipal	Crisp County Power Commission
		Eagle & Phoenix Mills
EAPM	Industrial	Fulton Bag & Cotton Mills
FUBC	Industrial	Georgia Power Company
GEPC	Private	Graniteville Company
GRCO	Industrial	Habersham Mills
HAML	Industrial	Hercules Powder Company
HEPC	Industrial	Okefenokee Rural Electric Membership Corporation
OKRE	Cooperative	Savannah Electric & Power Company
SAEP	Private	South Carolina Electric & Gas Company
SOCG	Private	Three-Notch Electric Membership Corporation
THNE	Cooperative	Thomasville
THWL	Municipal	U. S. Army
USAR	Federal	White, James G. Estate
WHJG	Private	

PRINCIPAL ELECTRIC FACILITIES —Continued

Utility abbreviations	Type of owner	Owner	Utility abbreviations	Type of owner	Owner
ABWE	Municipal	SOUTH CAROLINA Abbeville	SOOG	Private	SOUTH CAROLINA (continued) South Carolina Electric & Gas Company
DUPC	Private	Duke Power Company	SOGC	Private	South Carolina Generating Company
GRCE	Cooperative	Greenwood County Electric Power Company	USAT	Federal	Atomic Energy Commission

Note: This information was adapted from June 30, 1961 data supplied by Federal Power Commission.

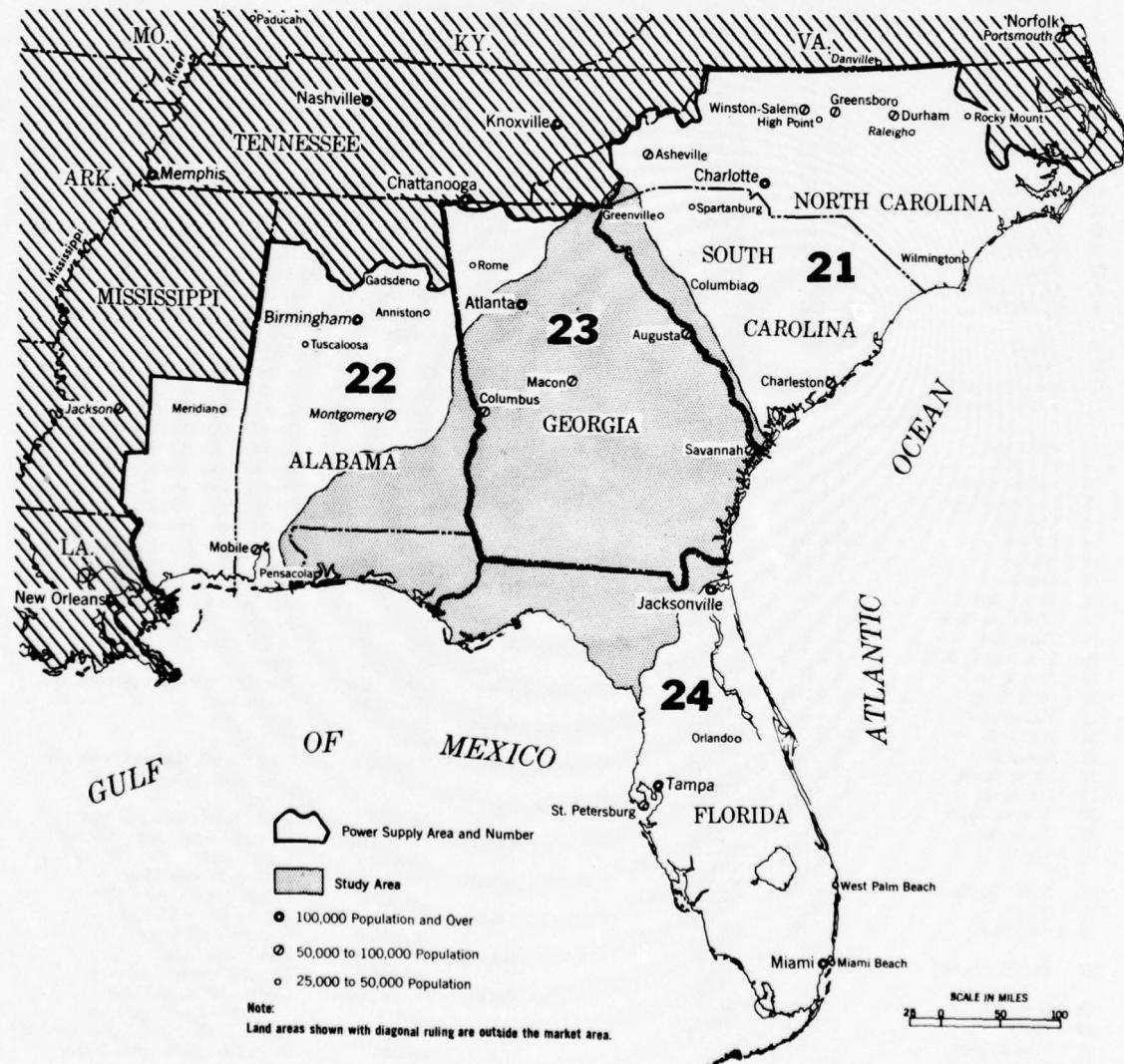


Figure 2.3 Power Market Area.

construction and to the increased use of electrical appliances including air conditioning, electric heating, and heat pumps.

Commercial requirements for electrical energy are influenced by population increases, higher per capita incomes, a rising level of living, and by greater activity in wholesale and retail trade. These economic and social indicators are reflected in greater uses of lighting, increased use of electrically operated service and office equipment, and expanded use of air conditioning and electric heating. The heat pump is rapidly becoming adopted in commercial establishments for both cooling and heating. Many restaurants are installing electric cooking equipment. These factors, plus normal growth trends, are reflected in the commercial load requirements.

Industrial power requirements in the market area are supplied from two sources. The larger portion is supplied by purchased power and a smaller portion by industrial generation. The large energy-consuming industries in the market area include: Textiles, primary metals, pulp and paper, chemicals, and machinery. The future industrial requirements of the market area will depend primarily upon further development and utilization of natural resources, general economic conditions, and the extent to which the area can compete successfully in the domestic and foreign markets. The electrification of industrial processes, the improvements in production methods, and new technological products are increasing the energy requirements in the manufacturing segment of the industrial field. The estimates for industrial usage reflect the increased use of natural resources, the changes from semifinished products to finished products, and competition among manufacturing businesses.

Total Future Requirements, Market Area

Table 2.28 gives the estimated future power requirements for the market area and power supply areas.

Southeast River Basins Area Requirements

Distribution of electric energy to ultimate users within the Southeast River Basins area is by electric membership cooperatives, municipalities, and private utility companies.

The electric membership cooperatives provide service in most of the rural areas with a major portion of the energy being distributed to farm

TABLE 2.28
Estimated Future Power Requirements
All Utility Systems

Item	Year	
	1975	2000
Power supply area 21		
Energy for load (million kw.-hr.)	59,239	134,989
Annual maximum demand (thousand kw.)	10,616	24,078
Annual load factor (percent)	63.7	64.0
Power supply area 22		
Energy for load (million kw.-hr.)	34,743	75,661
Annual maximum demand (thousand kw.)	6,295	13,602
Annual load factor (percent)	63.0	63.5
Power supply area 23		
Energy for load (million kw.-hr.)	32,236	72,939
Annual maximum demand (thousand kw.)	5,984	13,430
Annual load factor (percent)	61.5	62.0
Power supply area 24		
Energy for load (million kw.-hr.)	45,369	101,352
Annual maximum demand (thousand kw.)	9,417	20,846
Annual load factor (percent)	55.0	55.5
Market area		
Energy for load (million kw.-hr.)	171,587	384,941
Annual maximum demand (thousand kw.)	32,312	71,956
Annual load factor (percent)	60.6	61.1

and rural nonfarm customers. As urban centers throughout the Southeast River Basins area expand, there will be a shift to a greater number of customers in the rural nonfarm classification. The commercial load also will tend to increase as more service type establishments locate in the suburban areas now being served by the cooperatives. Industrial load growth will depend substantially on the expansion of small owner operated plants and location of low power demand industries such as apparel plants.

Municipal load growth is, in most cases, restricted to the city limits. As cities expand their limits, they may purchase existing facilities serving electrical energy in the new area. Electric load growth will depend upon the factors increasing the electrical load in a restricted area and to expansion of service area.

The private utility companies service area covers the entire Southeast River Basins area except for specific areas served by the cooperatives or municipalities. The utility companies transmission systems and subtransmission systems de-

TABLE 2.29
Estimated Future Power Requirements
All Distribution Systems

Basins	Year		
	1952	1956	1959
Savannah			
EMC* (million kw.-hr.)	187.7	570.2	1,654.8
Municipal (million kw.-hr.)	98.7	202.2	429.5
Utility (million kw.-hr.)	2,347.6	5,680.9	14,300.8
Total (million kw.-hr.)	2,634.0	6,453.1	16,385.1
Demand (thousand kw.)	504.5	1,180.5	2,983.2
Load factor (percent)	59.6	62.4	62.7
Ogeechee			
EMC* (million kw.-hr.)	53.5	165.7	376.4
Municipal (million kw.-hr.)	0	0	0
Utility (million kw.-hr.)	155.3	564.3	1,424.4
Total (million kw.-hr.)	208.8	730.0	1,800.8
Demand (thousand kw.)	51.8	166.7	373.8
Load factor (percent)	46	50	55
Altamaha			
EMC* (million kw.-hr.)	367.1	1,031.4	2,508.9
Municipal (million kw.-hr.)	106.1	276.2	574.0
Utility (million kw.-hr.)	2,721.6	10,040.1	20,391.4
Total (million kw.-hr.)	3,194.8	11,347.7	23,474.3
Demand (thousand kw.)	636.5	2,106.3	4,322.1
Load factor (percent)	57.3	61.5	62.0
Satilla-St. Marys			
EMC* (million kw.-hr.)	65.9	166.7	351.0
Municipal (million kw.-hr.)	28.5	50.6	84.0
Utility (million kw.-hr.)	584.6	1,825.9	4,936.5
Total (million kw.-hr.)	679.0	2,043.2	5,371.5
Demand (thousand kw.)	138.4	405.6	1,030.6
Load factor (percent)	56	57.5	59.5
Swanee			
EMC* (million kw.-hr.)	178.3	478.3	1,177.4
Municipal (million kw.-hr.)	116.3	262.3	526.5
Utility (million kw.-hr.)	361.2	1,207.7	3,745.4
Total (million kw.-hr.)	655.8	1,948.3	5,449.3
Demand (thousand kw.)	132.0	372.5	1,038.5
Load factor (percent)	56.7	59.7	59.9
Ochlockonee			
EMC* (million kw.-hr.)	64.1	226.1	702.4
Municipal (million kw.-hr.)	326.1	914.7	2,716.1
Utility (million kw.-hr.)	72.1	225.9	621.7
Total (million kw.-hr.)	462.3	1,366.7	4,040.2
Demand (thousand kw.)	93.7	274.7	810.6
Load factor (percent)	56.3	56.8	56.9
Apalachicola-Chattahoochee-Flint			
EMC* (million kw.-hr.)	367.2	1,099.8	3,061.2
Municipal (million kw.-hr.)	653.1	1,533.1	3,547.7
Utility (million kw.-hr.)	4,268.5	16,273.8	38,554.4
Total (million kw.-hr.)	5,288.8	18,913.2	45,153.3
Demand (thousand kw.)	1,050.0	3,515.1	8,327.1
Load factor (percent)	57.5	61.4	61.9
Choctawhatchee-Perdido			
EMC* (million kw.-hr.)	255.9	707.9	1,696.0
Municipal (million kw.-hr.)	128.6	296.3	591.0
Utility (million kw.-hr.)	1,521.8	5,249.1	15,048.1
Total (million kw.-hr.)	1,906.3	6,253.3	17,335.1
Demand (thousand kw.)	362.1	1,133.1	3,116.4
Load factor (percent)	60.1	63	63.5
Southeast River Basins			
EMC* (million kw.-hr.)	1,539.8	4,446.1	11,528.1
Municipal (million kw.-hr.)	1,457.4	3,535.2	8,458.8
Utility (million kw.-hr.)	12,002.7	41,067.7	99,022.7
Total (million kw.-hr.)	14,999.9	49,049.0	119,009.6
Demand (thousand kw.)	2,969.0	9,154.5	22,002.3
Load factor (percent)	57.7	61.2	61.7

Source: Electric Membership Cooperatives.

liver energy from sources to marketing entities and to their own ultimate consumers through their local distribution systems. The load growth of the Southeast River Basins area is affected by the same economic factors that prevail in the Southeast Power Market area with variations due to local conditions.

Total Future Requirements, Southeast River Basins Area

The estimated future power requirements for the basin areas and the Southeast River Basins area are given in Table 2.29 by class of distribution.

Energy and Capacity Requirements - Market Area

To meet the power requirements given in Table 2.28 will require construction of additional generating plants to serve the market area. For the market area, the load is expected to increase from 11,436,000 kilowatts and 58,918 million kilowatt-hours in 1958 to 32,312,000 kilowatts and 171,587 million kilowatt-hours in 1975, and to 71,956,000 kilowatts and 384,941 million kilowatt-hours in the year 2000. In addition to these load requirements, reserve capacity should be provided to assure continuity of service in case of equipment outage. The amount of this reserve capacity is usually determined by estimating the probable outage based on operating experience. A 10-percent reserve requirement above the peak is assumed for the present report. The estimated total capacity required to meet the estimated future loads by power supply areas and market areas are given in Table 2.30.

TABLE 2.30

Total Capacity Required for Load and Reserve for Market Area (thousands of kilowatts)

Power supply area	Year	Capacity for load	Capacity for reserve	Total capacity
21	1975	10,616	1,062	11,678
	2000	24,078	2,408	26,486
22	1975	6,295	630	6,925
	2000	13,602	1,360	14,962
23	1975	5,984	598	6,582
	2000	13,430	1,343	14,773
24	1975	9,417	942	10,359
	2000	20,846	2,085	22,931
Market area	1975	32,312	3,232	35,544
	2000	71,956	7,196	79,152

To estimate the additional energy generating facilities required to meet the future requirements, an analysis was made of existing facilities, facilities under construction, and those facilities definitely scheduled. To accomplish this analysis, load duration curves representative of the characteristics of the future power supply were prepared based on reported 1958 data. Also, to represent adequately the actual new construction required, a rate of retirement of existing facilities had to be assumed. The estimated future additional power needs for the four power supply areas after use of existing sources, projects under construction, and projects definitely scheduled are summarized in Table 2.31.

Energy and Capacity Requirements, Southeast River Basins Area

The Southeast River Basins area electric load is estimated to increase from 2,969,000 kilowatts and 14,999.9 million kilowatt-hours in 1959 to 9,154,500 kilowatts and 49,049.0 million kilowatt-hours in 1975, and to 22,002,300 kilowatts and 119,009.6 million kilowatt-hours in the year 2000. To meet this increasing load will require construction of new generating facilities either within the Southeast River Basins or within the market area adjacent to the Southeast River Basins area.

It is recognized that the above values are conservatively low and will probably be reached earlier than projected. However, these conservative values will be attained under the proposed economic development and therefore show the magnitude of electric power requirements which must be met.

Potential Hydroelectric Projects

The various potential hydroelectric projects proposed for possible development in the Southeast River Basins area by basins with capacity and average annual generation are listed in Table 2.33. The projects are included in the comprehensive plan for the Southeast River Basins.

In addition, several other potential projects were studied. These hydroelectric projects are not economically justified at the present time as power developments. However, as economic conditions change, further consideration should be given to the power potential, a purpose in many

TABLE 2.31
**Power Supply Requirements After Existing, Under Construction
 and Scheduled Supply Utilized**

	1975		2000	
	Energy (million kw.-hr.)	Capacity (thousand kw.)	Energy (million kw.-hr.)	Capacity (thousand kw.)
Power supply area 21				
Requirements	59,239	11,678	134,989	26,486
Power supply used	37,595	6,728	6,277	2,259
Additional supply needed				
For load	21,644	4,500	128,712	22,025
For reserve	—	450	—	2,202
Total	21,644	4,950	128,712	24,227
Power supply areas 22 and 23				
Requirements	66,979	13,507	148,600	29,735
Power supply used	39,416	7,434	10,472	3,302
Additional supply needed				
For load	27,563	5,521	138,128	24,030
For reserve	—	552	—	2,403
Total	27,563	6,073	138,128	26,433
Power supply area 24				
Requirements	45,369	10,359	101,352	22,931
Power supply used	29,304	4,198	2,623	390
Additional supply needed				
For load	16,065	5,601	98,729	20,492
For reserve	—	560	—	2,049
Total	16,065	6,161	98,729	22,541

multiple-purpose projects. Potential projects investigated but not included in the proposed plans as power projects are listed in Table 2.32. There are other potential hydroelectric sites

located within the Southeast River Basins area which need to be investigated as economic conditions dictate.

By the year 2000, the Southeast River Basins area will have a demand of approximately 22 million kilowatts. The installed capacity of the projects listed in Table 2.33 of 2.9 million kilowatts is only about 13 percent of the total. Including existing hydroelectric capacity of 867,200 kilowatts increases the hydroelectric facilities to 16.8 percent. The hydroelectric capacity as proposed for development and listed in Table 2.33 will be useful in meeting the load.

In the review of previous hydroelectric power studies, several potential hydro sites which had been economically justified at the time of the study are no longer economically feasible. This is due in most cases to the reservoir site being used for other purposes, thus increasing cost of land acquisition and relocations. To forestall the added costs of land and relocations, potential hydroelectric site locations should be purchased and held, particularly those sites in the Piedmont

TABLE 2.32
**Selected Hydroeleceric Power Projects Not
 in the Plan Needing Study Under Future
 Economic Conditions**

Basin and project	Installed capacity (kw.)	Average annual energy (thousand kw.-hr.)
Savannah basin		
Upper Whitewater	12,500	17,700
Lower Whitewater	22,000	32,100
Chattooga	44,000	53,900
Satilla-St. Marys basins		
Macclenny	37,000	23,400
A-C-F basins		
New Bridge	50,000	34,400
Irwins Bridge	20,000	14,800
Mud Creek	36,600	48,400
Miona	39,000	63,000
Mountain Creek	42,000	60,000

TABLE 2.33
Hydroelectric Power Supply
Projects Under Construction and
Selected Potential Projects

Basin and project	Installed capacity (thousand kw.)	Average annual energy (thousand kw.-hr.)
Savannah basin		
Horsepasture	58	88,500
Jocassee	150	77,100
Newry-Old Pickens	150	93,800
War Woman	80	50,300
Sand Bottom	66	42,800
Rogues Ford	120	77,500
Camp Creek	100	75,000
Hartwell*	330	450,000
Trotters Shoals	310	471,400
Tallow Hill	172	113,000
Anthony Shoals	100	61,500
Burtons Landing	100	345,000
Stokes Bluff	60	197,000
Total	1,796	2,142,900
Altamaha basin		
Peachstone	13	21,000
Laurens Shoals	95	120,000
Abbeville	50	126,100
Coopers Ferry	50	128,700
Goose Creek	180	275,000
Total	388	670,800
Apalachicola-Chattahoochee-		
Flint basins		
Spewell Bluff	100	133,000
Lazer Creek	87	121,600
Lower Auchumpkee	81	122,800
Lower Vada	28	167,000
Cedar Creek	50	101,000
Franklin	50	108,500
West Point	107	191,000
Walter F. George*	130	436,000
New Riverview	65	115,000
Columbus	30	130,000
Total	728	1,625,900
Choctawhatchee-		
Perdido basins		
Crestview	47	53,000
Total	2,959	4,492,600

* Under construction by Corps of Engineers.

and Blue Ridge provinces. Reservoirs created at these sites would be used for recreation, low-flow augmentation, and municipal and industrial water supplies as well as for the generation of electrical energy.

Nuclear and Other Future Power Sources

Part of the additional capacity required to meet the increasing electric load may be in

nuclear-fueled plants. As more experience is gained in construction and operation, and as technological advances in nuclear control are made, the nuclear-fueled plant will become more competitive with the conventional steam-electric plant. Advances in the use of fuel cells, thermal-electric, solar, and other types of devices to convert heat to electric energy have been made. These devices are being used at the present time for special applications. With further experimentation, development, and improvement, some type of direct conversion unit may become competitive with the present steam-electric central station plant for base load operation.

Pumped Storage

Development of pumped storage could serve as a source of peaking energy. The developments in the Savannah basin lend themselves to pumped storage operation. The Clark Hill Reservoir could act as an afterbay for a pumped storage unit in the Trotters Shoals project. The Newry-Old Pickens reservoir could make a pumped storage unit attractive in the Jocassee project. There are many other potential pumped storage developments in the Southeast River Basins area associated with conventional hydroelectric developments. In the Piedmont province there are potentials for classical pumped storage units along the major streams transversing the area. No such projects are included in the comprehensive plan.

Gas Turbines

Recent developments in the application of aircraft-type jet engines as prime movers of electric generators indicate that they have a potential for peaking purposes. The initial cost per kilowatt is considerably less than conventional thermal plants, thus reducing fixed charges. The plants can be fully automated reducing operator costs offsetting to some degree the high costs of fuel. These installations have further advantages of site location, cooling water requirements, and load availability. One major disadvantage is the problem of noise suppression.

Transmission

In the market area the prevailing transmission voltages have been from 100 kilovolts to 230 kilovolts. This latter voltage has only recently been constructed. Studies by the Federal Power Com-

mission indicate that a super-transmission grid of the 230/500 kilovolt range will be needed. This proposed network would connect major load centers with the major generating centers and would facilitate the interchange of power between areas. In addition, radial transmission lines to connect new generating sources, nuclear, conventional fuel, or hydroelectric, will be needed. The Southeast River Basins area has the start of a 230-kilovolt grid system between power supply areas 22 and 23. A 230-kilovolt tie between power supply areas 21 and 23 will be completed through the Hartwell project on the Savannah River. Transmission is not and will not be a problem in meeting future electric requirements. Higher voltage and direct current transmission may be in the picture by the year 2000.

Comprehensive Plan

Power elements of the comprehensive plan are all part of multiple-purpose projects. Table 2.33 summarizes by basins the capacity and energy data. Benefits and costs are summarized in Table 2.34.

TABLE 2.34
Summary of Benefits and Costs of Hydroelectric Power by Projects by Basins (thousands of dollars)

Basin and project	Annual equivalent Benefits	Costs	Allocated investment costs
Savannah basin			
Horsepasture	1,596.2	1,450.8	20,838.3
Jocassee	3,718.3	3,676.2	58,383.8
Newry-Old Pickens	3,763.0	3,584.6	56,439.8
Chattooga unit			
4 projects	9,228.0	8,839.2	136,886.6
Trotters Shoals	8,527.0	5,760.3	74,976.3
Tallow Hill	4,278.0	4,326.1	73,982.6
Anthony Shoals	2,476.0	2,406.7	38,088.8
Lower Savannah	4,284.4	4,928.1	113,780.9
Altamaha basin			
Peachstone	357.0	346.8	4,825.2
Laurens Shoals	2,518.5	2,861.1	51,200.9
Abbeville	1,495.5	1,637.9	29,933.6
Coopers Ferry	1,502.5	1,606.6	29,845.3
Goose Creek	4,900.5	4,900.3	84,755.3
A-C-F basins			
Spewell Bluff	2,669.0	2,489.8	39,685.1
Lazer Creek	2,338.0	2,014.0	30,515.7
Lower Auchumpkee	2,202.7	2,110.0	33,918.3
Lower Flint	1,097.7	1,097.7	19,650.0

(continued)

Basin and project	Annual equivalent Benefits	Costs	Allocated investment costs
Cedar Creek	1,364.0	1,251.2	18,646.8
Middle Chattahoochee*	4,100.0	4,240.9	69,197.6
West Point	2,166.4	2,018.7	34,005.6
Choctawhatchee			
Perdido basins			
Crestview	1,154.0	1,122.6	18,080.0

* Includes Franklin, New Riverview, and Columbus.

Bibliography

Federal Power Commission. *Power Utilization Study*, Regional Office, Atlanta, Georgia, August 1960.

Department of Agriculture. *Bulletin 1-1*, annual publication.

Supplemental Data

Work plan outline referred to in the narrative on hydroelectric power and industrial development studies follows. Other pertinent data on water supply studies are included in the files of the U. S. Study Commission, Southeast River Basins.

WORK PLAN - HYDROELECTRIC POWER

(edited to delete administrative details)

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Summary . . .

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Description of Study Area Summary of Developed and Potential Water Power

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Electric Power Requirements of Market Area

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Portion of Future Loads Which Could be Supplied by Existing Power Sources and Projects Under Construction

Power Supply Available
Hydroelectric
Fuel-Electric
Total
Power Requirements
For Load
For Reserve
Total
Use of Power Supply in Future Loads
Loading of Supply in Load Duration Curves
Additional Power Needs

Portion of Future Loads Which Could be Supplied by Existing Power Sources, Projects Under Construction and Potential Projects

Power Supply Available
Hydroelectric
Fuel-Electric
Total
Power Requirements
For Load
For Reserve
Total
Use of Power Supply in Future Loads
Loading of Supply in Load Duration Curves
Additional Power Needs

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Annual Capacity Cost
Incremental Energy Cost
Total Power Costs

Average At-Site Hydroelectric Values by River Basins
Savannah
Altamaha
Satilla-St. Marys-Suwannee
Apalachicola

SECTION X — SOIL CONSERVATION AND UTILIZATION

General Concept

The general objective in making the soil conservation and utilization studies is the identification and utilization within the study area of those conservation techniques that will (1) avoid costly erosion of soil, (2) protect and develop land resources for future uses, (3) manage soil and plant resources for efficient and continuing production of foods and fibers for human needs, and (4) protect and improve watersheds and water resources for both agricultural and urban uses. Cropland, pasture, and range and land classed as "other" are considered, but needs for woodland, including shelterbelt planting, are discussed in Section XI, Forest Conservation and Utilization.

The application of soil conservation to areas needing treatment is for those areas which it is

estimated will contribute to a sustained agricultural production, to maintenance of the soil resource base, and to reduction of sediment deposition in reservoirs, stream channels, and coastal waters. Soil conservation measures include those expected to extend the useful life of floodwater retarding structures and major reservoirs. These measures frequently improve water quality thereby reducing the cost of treatment for municipal and industrial use and enhancing the value of reservoirs for such uses as wildlife and fish. Where structural measures are not feasible, land treatment provides a means of conservation of watershed and river basin soils. The program includes restoration and improvement of the soil resource through land-use adjustments and takes into account the problems of people who use the land to earn a livelihood.

The general planning procedure consists of inventorying existing facilities, and accomplishments; determining future needs for conservation programs; examining the condition of the present soil resource and problems associated therewith; determining (1) areas having the more serious land-use problems and greater agricultural hazards; (2) areas needing treatment to conserve the soil resource base; and (3) areas needing treatment to protect the plant cover. Compilation of these data assisted in developing soil conservation plans and alternatives for the study area and in developing information of a quality suitable for incorporation in the comprehensive plan.

Definitions, criteria, and discussion of significant items include:

Soil conservation and utilization is the protection, use, maintenance, and improvement of the soil resource insofar as practicable to best serve the human needs.

A capability unit is a grouping of soils that are nearly alike in suitability for plant growth and responses to the same kinds of soil management. Capability assumptions and criteria are:

(1) Soils within a capability class are similar only with respect to degree of limitations in soil use for agricultural purposes or hazard to the soil when it is so used. The capability classification is not a grouping of soils according to the most profitable use to be made of the land.

(2) Research data, recorded observations, and experiences are used as the basis for placing soils in capability units, subclasses, and classes.

(3) A favorable ratio of output to input is one of several criteria used for placing any soil in a class suitable for cultivated crop, grazing or woodland use, but no further relation is assumed or implied between classes and output-input ratios.¹

(4) Capability Classes I through IV are distinguished from each other by a summation of the degree of limitations or risks of soil damage that affect their management requirements for long-time sustained use for cultivated crops.

(5) Soils with such physical limitations that common field crops can be cultivated and harvested only by hand are not placed in Classes I,

¹ Based on long-term economic trends for average farms having moderately high-level management and applicable to broad areas.

II, III, and IV. Some of these soils need drainage or stone removal, or both, before some kinds of machinery can be used.

Land is classified in eight standard Land Capability Classes in accordance with the physical conditions affecting its inherent capabilities. The risks of soil damage or natural limitations in use become progressively greater from Class I to Class VIII. These classes of land do not represent a scale of fertility or productivity. They do classify the land according to increasing restrictions of use and treatment if continued production is to be expected from a given area.

Generally, Land Classes I through IV are suitable for cultivation with proper conservation treatment. Classes V through VI are best suited for pasture, woodland, or wildlife. In Class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

Land Capability Classes II to VIII, inclusive, are subclassified by factors which restrict use. Class I land, with no major limitations, is not subclassified. Subclasses used with each Land Capability Class are designated by lowercase letter symbols as follows: Erosion (subclass "e") — damage from and susceptible to water or wind erosion; excess water (subclass "w") — damage from and susceptible to overflow, high water tables, poor surface or internal drainage, or combinations of these elements; unfavorable soil conditions (subclass "s") — shallowness, stoniness, low moisture-holding capacity, low levels of fertility difficult to correct, salinity, and acidity are the major unfavorable soil characteristics in the study area.

Each land capability subclass may be a dominant land problem or a secondary one where the dominant problem is represented by another subclass. Only for cropland and "other" land, however, were secondary problem classifications used to refine interpretations of physical conditions to determine future conservation needs. Information on cover conditions provided additional criteria for determining treatment needs for pasture and range.

Conservation needs are expressed in terms of the acres that require treatment in order to maintain production in line with the basin and national interests and to insure protection of

the soil resource and of the plant cover. Consideration was given to regional and local conditions and the needs of the people for income.

Conservation treatment on expected pasture and range acreage is expressed as acres needing treatment for conservation problems related to the establishment, protection, and maintenance of cover.

Cropland on which the dominant problem is water or wind erosion or both includes all land capability units which are classified as having an erosion hazard as the dominant problem (IIe through VIIe).

Cropland with no problems that limit use is Class I land without special potential or actual conservation problems except those related to the restoration and maintenance of fertility and tilth which may be solved by the methods generally recommended and used in the community.

"Other" land includes farmsteads and idle land; wildlife areas; other land not classified into other land use, such as built-up and urban areas.

Land Capability Classification is a grouping of kinds of soil into special units, subclasses, and classes according to their capability for intensive use and the treatments required for sustained use. It is an interpretive classification based on the effects of combinations of climate and permanent soil characteristics on risks of soil damage, limitations in use, productive capacity, and soil management requirements. Slope, soil texture, soil depth, effects of past erosion, permeability, water-holding capacity, type of clay, and many other similar features are considered permanent soil qualities and characteristics.

Land treatment measure is a tillage practice, a pattern of tillage or land use, or any land improvement, with a substantial effect of reducing runoff and sediment production or of improving use of drainage and irrigation facilities. Examples are contouring, improved crop rotations, controlled grazing, land leveling, and field drainage. In hydrologic computations, nonbeneficial measures, such as straight-row, poor-rotation corn, are included for convenience in evaluation. In general conservation work "land treatment measure" has a broader meaning that includes measures to improve the soil, control sheet erosion, and increase soil fertility.

Pasture and range are lands in grass or other long-term forage growth that are used primarily

for grazing, including grassland, nonforested pasture, and other grazing land with the exception of pasture in the crop rotation. It may contain shade trees or scattered timber trees with less than 10 percent canopy, but the principal plant cover is such as to identify its use primarily as permanent grazing land.

Unfavorable soil conditions include salinity, alkalinity, acidity, low fertility, stoniness, shallowness to rock or some other conditions that limits root development, or low moisture-holding capacity.

Work Plan

Determining the scope of the studies commenced in November 1959, when an evaluation was made of the quality, quantity, and usability for Commission purposes of the limited basic data available. This evaluation led to determining of gaps and considering ways and means of filling these.

A functional work plan was prepared setting forth the requirements of studies of soil conservation and utilization. This constitutes a guide for conducting the soil conservation study. The work plan is not a detailed document but serves as a basis for carrying out specific, detailed work agreements entered into with an agency or other organization carrying out specific tasks for the Commission.

The work plan represents the basic document of the Commission to ascertain the "what, where, who, when, and how" of the soil conservation and utilization study. Following a review and critical analysis, some modifications were made in the work plan.

Subsequently, a committee of Federal and State agency specialists having responsibilities for and technical knowledge of soil conservation and utilization made review comments on the contents of the work plan. This committee functioned as a part of the collaborative planning process and was composed of representatives from the States of Alabama, Florida, Georgia, and South Carolina. The committee served in an advisory capacity and was concerned primarily with the identification of basic data required and with reviewing proposals for work assignments to be performed by designated agencies.

Following a review by the Commissioners on December 17, 1959, the final version of the requirements for the study of soil conservation and

utilization and work plans was revised and dated January 11, 1960.

The completed work plan is included at the end of this Section.

Detailed items of the soil conservation and utilization study were developed into a technical supplement. The technical supplement is based upon the work plan and describes the tasks and job specifications for the study. The technical supplement contains study items on basic data; outlines methodology and requirements for detailed technical studies of the 1960 situation, conditions, and facilities; and lists procedures for preparing first estimates of 1975 and 2000 needs for soil conservation and utilization resource development. Initial drafts of the technical supplements were accorded the same type of review as had been previously given to the functional work plans. The final version of the soil conservation and utilization technical supplement containing detailed items of study is dated April 5, 1960. After the completion of the technical supplements, contacts were made with agencies who could contribute needed data.

Work Performance

Studies carried out consisted of those performed through agreement with the U. S. Department of Agriculture and those performed by the Commission staff and consultants.

A work agreement with the Economic Research Service contains six study items which constitute a "Technical Supplement for Basic Economic Studies." The details and specific working procedures for this work is in a "Supplement to Technical Supplement for Basic Economic Studies." Most of the studies done by Economic Research Service involved agricultural functions other than soil conservation and utilization. Appendix 9, Economics, contains information on these two studies.

Another work agreement with the Economic Research Service consists of "Technical Supplement A to Work Plan," covering terminal studies. Work done by Economic Research Service under this agreement includes net return development, usage, and total crop and pasture production. Further work under this agreement defines the collaboration between the Soil Conservation Service and Economic Research Service in determining yield responses from specific agricultural measures and practices. Economic Re-

search Service completed its studies for the Commission in March 1962.

A work agreement with the Soil Conservation Service provided for that agency to furnish technical data from its files, provide consulting services, and do field work on study items, to participate in plan formulation as requested, and perform other work as specified in the agreement and supplements thereto.

Work agreements with the Soil Conservation Service and the Economic Research Service set forth the scope of the work, the monies and services involved, the time schedule, and the general understanding of the two parties involved as to payments to be made, billing procedures, and personnel where known.

Available data in Soil Conservation Service files were supplemented by data sheets prepared to collect information on soil conservation and utilization and related subjects. Information for the data sheets was compiled by each work unit office of the Soil Conservation Service in the Southeast River Basins area. The information supplied from the field was assembled and prorated, where necessary, to each individual basin area.

Conservation Needs Inventory (CNI) data compiled by the U. S. Department of Agriculture were also provided by the Soil Conservation Service for the State and county portions of the Southeast River Basins area. This inventory is a systematic collection of facts for each county, watershed, and river basin regarding the soil resources and includes the problems in their use and an estimate of the areas needing treatment. The inventory was developed from basic data regarding acreage in major land uses and acreage of each land use on various kinds of soil, classified by degree of slope, erosion hazard, and other limiting factors. Data from the CNI constituted the source of a major segment of basic data used by the Soil Conservation Service in developing report material. The CNI material was the basis of approximately 85 to 90 percent of the 1960 and 1975 information included in the technical memoranda. Estimates for the year 2000 are based on projections of the 1975 CNI. The Statistical Laboratory of Iowa State University at Ames, Iowa, compiled CNI data on statistical tapes by basins in two different forms, including basin areas and by counties or portions of counties within each basin. Information developed

from CNI along with additional inventory data supplied by the Soil Conservation Service was used to tabulate Land Capability Classes by area and land uses and determine soils groupings for yield and other purposes.

Much of the basic data used and not supplied by CNI came principally from the sources cited in the Bibliography at the end of this Section. Of these other sources, frequent reference was accorded the agricultural information shown in Appendix 9, Economics. The projections in Appendix 9, Economics, were used as guideposts in designing a framework for resource use and development and aided in solving potential conflicts between competitive resource use. While agricultural production requirements are shown in Appendix 9, it contains no estimate of resource development programs that may be required to meet the projection.

Technical Memoranda

The first phase of operations by the Soil Conservation Service involved the preparation of technical memoranda for each of the eight basins which were completed June 1, 1961. Included in the technical mem- nda are standard tables and appropriate narratives. The narratives explain tabular data, contain results of studies, and include supporting material and certain criteria followed by the agency conducting studies for the Commission.

With appropriate review by the Commission staff, the technical memoranda served as a basis for soil conservation and utilization memoranda subsequently developed by the staff. The technical memoranda also served as a reference when the single-purpose soil conservation and utilization plans and the comprehensive plans for land and water resource development were formulated.

Following the submission of the technical memoranda by the Soil Conservation Service, a work plan was devloped for terminal studies involving additional data and assistance in the expansion and interpretation of technical memoranda information. These work plans were developed by the Commission staff, with counsel and concurrence of the cooperating agency on procedures for performing terminal studies and submitting study results. These terminal studies were likewise covered by a terminal studies work plan with a terminal studies technical supple-

ment setting forth the specific study items to be covered by the Soil Conservation Service.

The formal arrangements with the Soil Conservation Service included a specific provision which invited the Soil Conservation Service to,

"Determine if any other projects should be added because of the impact of additional purposes, or if the phasing list should be modified. In the event any additional multiple-purpose needs and/or facilities are added to the initial purposes, make recommendations for adjustment of original program."

As set forth in the terminal studies instructions, each item of the terminal study was furnished as it was completed without being compiled into a report of all items by basins.

Functional Memorandum

After the development of a technical memorandum, the next step led to the development of basin functional memoranda by the staff specialist, with counsel and suggestions received from other Commission staff members. The functional memorandum is based on the combining of technical memorandum and basic studies with the experience and knowledge of the area by the staff specialist. For some items of work submitted by the agencies, conversion work performed by the staff specialist was virtually nonexistent; in others, it involved considerable co-ordination. Upon completion of the functional memorandum, these documents were used in formulating comprehensive basin plans which ultimately were combined into the Report. This later step is described in this Appendix in Part Three, particularly in Sections III and IV, thereof.

Prior to submitting results of the studies, these were reviewed, correlated, and approved by the U. S. Department of Agriculture through its Southeast Field Advisory Committee. This group designated by the Secretary of Agriculture included as Chairman, the Commission member from the Department of Agriculture who also represented the Soil Conservation Service, along with representatives of the Economic Research Service and the U. S. Forest Service. Subsequent review and approval of these actions were given by the U. S. Department of Agriculture Advisory Committee in Washington.

As needed, informal meetings and discussions between representatives of these agencies were held for the exchange of information and data with concurrence of the Field Advisory Committee as deemed necessary. No attempt was made by U. S. Department of Agriculture agencies to reconcile differences in data developed or derived from different sources. Such reconciliation was handled by the technical staff of the Commission.

Coordination

Coordination of agency work assignments was accomplished mainly by informal liaison during all stages of studies under the review of the Commission staff. Commission staff members assisted in such coordinating efforts as initiating the work, providing consultation and coordination of data, and periodically reviewing the adequacy of funds. A significant part of the coordination was achieved when the work plan was prepared, reviewed, and discussed with staff members of agencies that later undertook work. Within the U. S. Department of Agriculture, the Field Advisory Committee, which included representatives of the main agencies within the Department doing work for the Commission, contributed to the coordination effort.

A committee of specialists referred to earlier in the discussion of work plans performed some coordination of studies through continuing contacts. In addition, the Land, Water, and Economics Groups rendered advice and comments. These groups were organized for technical review of preliminary reports, including information on soil conservation and utilization, and for review and comments on other information developed.

Coordination of report material received from agencies performing studies on soil conservation and utilization was achieved after an appraisal of information from all sources.

Findings

Inventory

On the basis of a summary of certain Conservation Needs Inventory data, it is estimated that erosion was a dominant problem in 1959 on the following acreage: Slight erosion—5.0 million; moderate erosion—9.7 million; severe erosion—4.7 million; very severe erosion—800,000; and gullied land, most severe erosion—100,000. Of the preceding acreage, erosion was determined to

be the dominant problem on 6.2 million acres in cropland, 2.7 million acres in pasture and range, and 1.4 million acres of other land. An additional 2.9 million acres of cropland, 700,000 acres of pasture, and 600,000 acres of other land had a dominant problem of unfavorable soil condition. These data were compiled to determine the magnitude of the erosion problem. Water erosion is a problem in all areas of the Southeast River Basins with the Piedmont and Upper Coastal Plain being most susceptible. At the time the Conservation Needs Inventory was developed, more than 720,000 acres were determined to have a crucial erosion damage reduction problem which cannot be solved by individual landowners but will involve project facilities, if a solution to this problem is to be achieved.

Exclusive of woodland as of 1960, conservation treatment in varying degrees had been applied on an estimated 40 to 50 percent of the land. The 40-50 percent range is due to the variation in treatment applied by States comprising the Southeast River Basins area. Conservation treatment applied has significantly lessened the erosion hazard on a large acreage. Significant changes in land-use patterns have occurred in the past 20 to 30 years. Although land-use data by basins are not available for past years, data by States illustrate how historical land-use changes have created new needs and opportunities. For the entire State of Georgia, pasture acreage doubled, cropland decreased by 3 million acres, and woodland increased by 5 million acres in the period from 1930 to 1960.

About 67 major soil and water conservation practices and measures are currently used on the various land uses in the States in the Southeast River Basins area.

According to the Conservation Needs Inventory, 12.5 million acres in cropland, pasture, and range in Land Classes I through IV, inclusive, were found to be suitable for safe, permanent use for growing adapted field crops with application of the proper combination of conservation measures. Over 9.7 million acres, or 78 percent of these classes, are used currently as cropland. Only 800,000 acres of Class I land were inventoried with almost 70 percent being used for crop production.

It was assumed 75 percent of soil conservation treatment would be applied by 2000 and pro-

jections of increased crop and pasture yields to 1975 and 2000 reflect the application of this rate of conservation treatments and other inputs. Also, it was assumed that a basic requirement for widespread attainment of soil conservation is the proper use of land for safe, continuing agricultural production. Fullest use of lands would place all lands in their most productive uses. This would necessitate shifting much pasture and woodland on land with suitable characteristics to more productive crops and pastures. This type of adjustment remains as a principal reserve of production potential to meet future needs in the study area.

Needs and Opportunities

From a study of the needs for agricultural production requirements shown in Appendix 9, Economics, it is concluded that the agricultural production goals established therein for the study area for the year 2000 can be substantially met without accelerated resource development through application of proven methods in technology and such changes in land use as might readily be made by landowners at reasonable conversion and crop production costs.

The more significant findings resulting from the studies involve the areas of the basins needing treatment for conservation rather than for production.

Needs for conservation treatment were developed separately for each land use, including land classed as other. These needs were determined on the basis of land use that county conservation needs inventory committees anticipate in 1975. These data account for all land of the agricultural land base and all expected shifts, both into and from each land use, expected to occur by 1975. Estimates for conservation treatment needed by basins for cropland for 2000 are shown in Table 2.35.

Based on projections of Conservation Needs Inventory data, it is estimated that, by the year 2000, 703,000 acres of cropland will be in Class I with few or no conditions that limit its use. The 703,000 acres of Class I land are expected to be distributed, by acres, in the study area as follows: Blue Ridge, 800; Piedmont, 34,400; Upper Coastal Plain, 626,500; and Lower Coastal Plain, 41,300. The distribution of the 703,000 acres by States, in acres, is expected to be: Ala-

TABLE 2.35
Conservation Treatment Estimates for Cropland,
Based on 2000 Land-Use Estimates
(thousands of acres)

Basin	Needs category		Total for treatment
	Dominant problem	Unfavorable soil conditions	
Savannah	554.4	101.9	656.3
Ogeechee	217.7	164.9	382.6
Altamaha	675.3	158.0	833.3
Satilla-St. Marys	46.6	47.2	93.8
Suwannee	289.4	592.7	882.1
Ochlockonee	184.3	115.3	299.6
A-C-F	877.3	313.3	1,190.6
Choctawhatchee-			
Perdido	412.5	197.7	610.2
Total	3,257.5	1,691.0	4,948.5

bama, 410,300; Georgia, 179,000; Florida, 87,000; South Carolina, 26,700; and North Carolina, negligible acreage.

In addition, nearly 3.3 million acres of cropland will need conservation treatment due to a dominant problem of erosion. More than 1.6 million acres of cropland will need conservation treatment due to unfavorable soil conditions. Thus, more than 4.9 million acres of cropland will need conservation treatment to conserve the soil resource by the year 2000, if they are to remain in that use. The approximately 4.9 million acres of cropland needing conservation treatment because of erosion and unfavorable soil conditions are expected to be distributed in the study area, in acres, as follows: Blue Ridge, 28,000; Piedmont, 921,000; Upper Coastal Plain, 3,151,000; and Lower Coastal Plain, 802,000. The distribution of the 4.9 million acres by States, in acres, is expected to be: Georgia, 2,905,100; Florida, 766,000; Alabama, 408,000; South Carolina, 821,000; and North Carolina, 1,900.

Tables for conservation treatment needs for pasture and range and other land were also compiled but are not included herein. However, summaries for these land uses follow. Pasture and range will need conservation treatment to conserve the soil resource and protect the plant cover in the year 2000 on about 3.8 million acres. The approximately 3.8 million acres of pasture and range needing conservation treatment are expected to be distributed in the study area, in acres, as follows: Blue Ridge, 42,600; Piedmont,

1,032,400; Upper Coastal Plain, 2,363,500; and Lower Coastal Plain, 427,300. The distribution of the 3.8 million acres by States, in acres, is expected to be: North Carolina, 4,500; South Carolina, 184,100; Georgia, 2,333,600; Florida, 652,700; and Alabama, 690,900.

Establishment or reestablishment of vegetation will be needed on 2.3 million acres and improvement of vegetative cover will be needed on 1.1 million acres of pasture and range. Some of the following problems of treatment or control may be expected to occur on the same acreage. In 2000, protection of cover on 1.2 million acres pasture and range will be needed to prevent overgrazing, on 370,000 acres to prevent fire damage, on 295,000 acres to prevent erosion, on 50,000 acres to prevent rodent damage, and on 704,000 acres to prevent noxious plant encroachment. Solutions to these problems include management of soil, water, livestock, and vegetation.

Treatment needs of cropland and of the land classed as other, as shown above, are related to a major extent to the conservation, stabilization, improvement, and maintenance of the soil resource itself and were determined by land capability units. Cropland and other land needs are expressed in terms of dominant problems, if any, requiring treatment. The problems of pasture and range are related both to the soil resource and to the development, improvement, and maintenance of the useful plant components of the vegetation. Needs for these two land uses, therefore, give consideration to the conditions of the vegetative cover as well as the soil. In determinations for the eight basin plans and the Report, the acres shown by the U. S. Department of Agriculture as needing conservation treatment by land uses, for dominant erosion and unfavorable soil conditions, for the year 2000 were reduced to 75 percent by the Commission staff. The assumption of 75 percent was made as an estimate of reasonable expectation of accomplishment by the year 2000. It was further assumed that an equal yearly application would be accomplished by farm operators.

Soil Conservation Benefits and Costs Data

A summary of tangible benefits and costs by basins and States is contained in Table 2.36.

Land-use data were available from several sources. The sources included U. S. Census of

Agriculture, Special Forestry Studies prepared by the U. S. Forest Service for the U. S. Study Commission, studies made by four land-grant colleges in the study area, Soil and Water Conservation Needs Inventory, and other studies.

The land-use data used for planning purposes by the U. S. Study Commission, Southeast River Basins, are shown in Tables 2.37, 2.38, and 2.39.

Alternatives

Although alternatives were studied, there was no opportunity to explore all alternatives. Some *land-use shifts and application of conservation practices* are not feasible according to present standards. Some of them will probably become feasible beyond the year 2000, whereas others may never warrant development.

Based on surveys of agricultural land conditions, about 8.5 million acres could be in cropland by 2000 for best land use within soil Capability Classes I through IV as the needs and limitations, the risk of damage, and the response to good management make these soil capability classes more suitable for yearly or periodic cultivation. By 2000, about 5.1 million acres could be in pasture and range for best land use within soil Capability Classes I through VI as the needs and limitations, the risks of damage, and the response to good management make these soil capability classes more suitable for production of forage crops such as hay, grass, and legumes. However, institutional problems, such as land-ownership patterns, individual farmer desires, and other influences will likely inhibit the occurrence of both of the foregoing alternative uses on cropland, pasture, and range.

On the 720,000 acres determined to have potential for project development involving crucial erosion damage reduction, it is estimated that individual action by landowners would be the most economically feasible alternative for achieving erosion damage reduction. Detailed individual studies will be required to determine if future project facilities for erosion damage reduction can be justified, particularly in the Choctawhatchee-Perdido basins.

Another alternative considered, but not studied, involved estimating the quantities of individual soil conservation practices and measures that may be installed on landowners farmlands in

TABLE 2.36
Summary of Soil Conservation Benefits and Costs
 (thousands of dollars) |

Basin program by States	Benefits Annual equiva- lent ¹	Costs			Investment
		Invest- ment	Annual equivalent OM&R ²	Total ¹	
Ogeechee					
Georgia	1,661	374	870	1,244.0	10,340
Satilla-St. Marys					
Georgia	738.4	258.8	271.8	530.6	7,160
Florida	182.0	56.2	85.6	141.8	1,555
Suwannee					
Georgia	2,303	474	1,022	1,496	13,120
Florida	2,557	318	872	1,190	8,800
Ochlockonee					
Georgia	1,260.3	220.2	467.8	688.0	6,098
Florida	801.9	154.0	302.0	456.0	4,262
Choctawhatchee-Perdido					
Alabama	2,924	723	1,458	2,181	20,010
Florida	823	213	424	637	5,890
Savannah					
South Carolina	1,113.9	311.5	594.0	905.5	8,619
Georgia	2,016.7	492.3	1,176.6	1,668.9	13,622
North Carolina	16.8	4.6	9.6	14.2	130
A-C-F					
Alabama	1,083	251	574	825	6,900
Florida	533	91	314	405	2,500
Georgia	5,414	1,825	2,435	4,260	50,500
Altamaha					
Georgia	5,320	1,536	2,434	3,970	42,490

NOTES: ¹ Consists of costs and returns to farmers.

² Operation, maintenance, and replacements costs at year 2000 are assumed to be equal to the annual equivalent operation, maintenance, and replacements costs.

TABLE 2.37
Land Use - 1959

Basin	Surface area (sq. mile)	Large water (sq. mile)	Land area (sq. mile)	Surface area (1,000 acres)	Large water (1,000 acres)	Land area (1,000 acres)
Savannah	10,577	278	10,299	6,769	178	6,591
Ogeechee	5,535	99	5,436	3,542	63	3,479
Altamaha	14,564	87	14,477	9,321	56	9,265
Satilla-St. Marys	5,520	95	5,425	3,533	61	3,472
Suwannee	11,020	91	10,927	7,053	58	6,995
Ochlockonee	6,329	126	6,203	4,051	81	3,970
A-C-F	19,798	282	19,516	12,671	180	12,491
Choctawhatchee-Perdido	14,742	529	14,213	9,435	339	9,096
Total	88,085	1,587	86,498	56,375	1,016	55,359

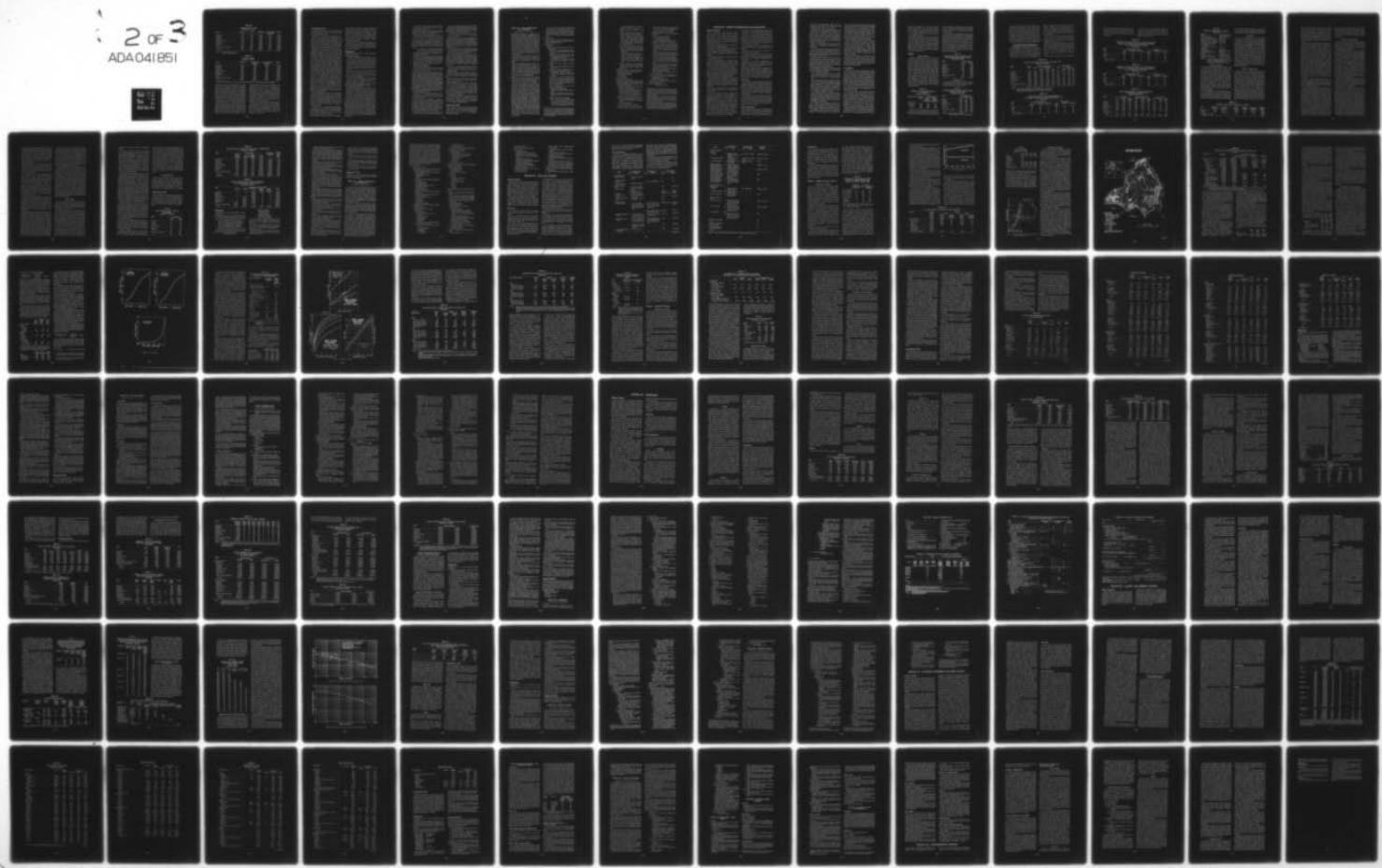
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UNITED STATES STUDY COMMISSION SOUTHEAST RIVER BASINS--ETC F/G 8/6
PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOU--ETC(U)
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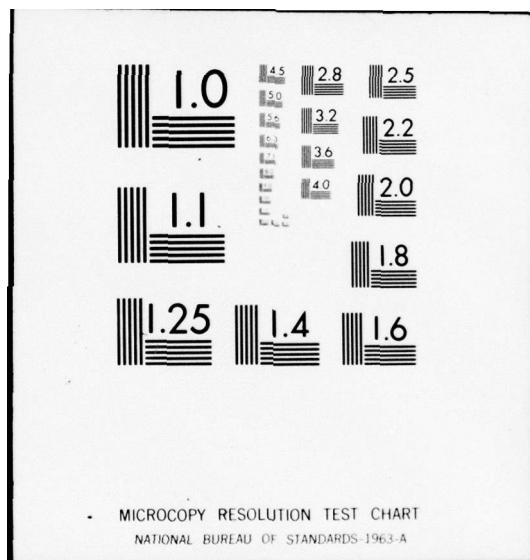


TABLE 2.38
Specific Land Use - 1959
(thousands of acres)

Basin	Cropland	Pasture ¹	Woodland	Urban, special, and other ²	Total
Savannah	1,017	543	4,508	523	6,591
Ogeechee	645	193	2,242	399	3,479
Altamaha	1,543	758	6,347	617	9,265
Satilla-St. Marys	281	96	2,716	379	3,472
Suwannee	1,138	418	4,705	734	6,995
Ochlockonee	469	193	3,056	252	3,970
A-C-F	2,246	1,153	8,169	923	12,491
Choctawhatchee-Perdido	1,181	625	6,629	661	9,096
Total	8,520	3,979	38,372	4,488	55,359

NOTES: ¹ Includes cropland pasture.

² Includes all small water bodies.

TABLE 2.39
Land Use - 2000
(thousands of acres)

Basin	Woodland	Cropland and pasture	Urban, special, and other	Total*
Savannah	3,925	1,815	650	6,390
Ogeechee	2,173	869	420	3,462
Altamaha	5,710	2,577	760	9,047
Satilla-St. Marys	2,542	465	420	3,427
Suwannee	4,410	1,738	790	6,938
Ochlockonee	2,842	821	300	3,963
A-C-F	6,152	4,350	1,857	12,359
Choctawhatchee-Perdido	5,905	2,166	970	9,041
Total	33,659	14,801	6,167	54,627

* Excludes 732,000 acres of land to be included in large water bodies to be developed in the period 1960-2000.

future years. This was not done due to the anticipated extensive changes in land use, landownership patterns, fluctuating economic conditions, individual preferences of landowners, changing needs for agricultural products, the unknown future policies of Federal, State, and local agencies, and for other reasons. Financial inability of landowners to apply the needed conservation practices will be a main factor in limiting the areas expected to receive conservation treatment.

Another reason for not considering the alternative of estimating the specific amounts of practices and measures that may be required on the cropland and grazing lands is due to past results. Most of the major 67 soil and water practices and measures currently being applied in the States in the Southeast River Basins area are

not necessarily satisfactory land treatment when applied singly or in improper combination, in insufficient intensity, or to a fundamentally wrong land use. Most of the land considered in the study area is in its 140,000 farms. The soil conservation program must be implemented by the farmers. Soil and water conservation district assistance is needed, but the farmers will determine how rapidly and to what degree the practices will be put into effect.

Estimates as to the intensity of installation of conservation measures would be only a prediction which could not include all the future influencing factors. Comprehensive soil conservation and utilization programs over large areas with great variations in conditions cannot be expected to apply fully.

Comprehensive Plan

The single-purpose plan was developed from the information received from the cooperating agencies and other sources.

Installation and annual cost information by basins by years were prepared. Backup data were prepared, giving sources of data, quantities, and unit cost used. Where locally derived data were not readily available on benefits ascribed to soil conservation and utilization, the Commission estimates were based on knowledge and information that was extrapolated from other sources.

Difficulties were encountered in determining benefits attributable to soil conservation. The difficulties stemmed from prior congressional legislative recognition that Federal assistance in soil and water conservation is in the public interest and due to the U. S. Department of Agriculture having previously found through experience that land treatment measures installed with such assistance produce combined public and private benefits in excess of their costs. Based on this congressional decision and U. S. Department of Agriculture policy, land treatment measures on open land installed principally for conservation of the lands upon which they are installed have not been evaluated monetarily by agencies in the U. S. Department of Agriculture. In the absence of such benefit data, the Commission staff (1) extrapolated data dealing with economic evaluation of soil conservation practices from sources listed in the Bibliography of this Section, (2) used cost-return information provided by three Soil Conservation Service State offices for comparison purposes, and (3) used judgment in determining the benefits attributable to soil conservation.

It was also difficult to estimate the agricultural production which may come from the application of soil conservation measures and practices versus technological developments such as improved and intensified fertilizer usage, applications of drainage and irrigation measures, improved crop varieties, mechanization, and greater managerial skills.

The total cost of recommended installation for the soil conservation and utilization program for 1960-2000 is \$202 million. Accumulated operation and maintenance for the same 40-year period amounts to \$274.8 million.

Farm ponds usually constructed by farmers

with technical assistance provided through soil conservation districts and sometimes with cost-sharing assistance provided through U. S. Department of Agriculture were included under soil conservation and utilization, although water stored in these ponds is frequently used for domestic water, irrigation, recreation, fishing, and esthetic purposes.

Although cost and benefit data are not contained in the report sections for sediment control, the incidental effects of the soil conservation program contributing to sediment reduction were considered.

Bibliography

Reports prepared for the U. S. Study Commission, Southeast River Basins:

Agricultural college studies:

University of Georgia. *Agricultural Resources in the Southeast River Basins of Georgia*, College of Agriculture, Department of Agricultural Economics, Georgia Agricultural Experiment Stations, Athens, Georgia, 1960.

Clemson College. *Agricultural Resources in the Savannah River Basin of North Carolina and South Carolina*, Department of Agricultural Economics, South Carolina Agricultural Experiment Station, Clemson, South Carolina, 1960.

University of Florida. *An Economic Evaluation of Agricultural Resources in Five River Basins of North and West Florida*, Department of Agricultural Economics, Florida Agricultural Experiment Stations, Gainesville, Florida, August 1960.

Auburn University. *Agricultural Land and Water Resources; Uses, Needs and Potentials*, Department of Agricultural Economics, Agricultural Experiment Station, Auburn, Alabama, July 1960.

Contents of the four preceding agricultural college studies are described in Appendix 9, Economics.

U. S. Department of Agriculture:

Technical Memoranda on Soil Conservation and Utilization and addenda thereto for Savannah - May 1961; Ogeechee - February 1961; Altamaha - May 1961; Satilla-St. Marys - March 1961; Suwannee - March 1961; Ochlockonee - March 1961; Apalachicola-Chattahoochee-Flint - May 1961; and Choctawhatchee-Perdido basins - April 1961, Soil Conservation Service, Athens, Georgia.

The Technical Memoranda for soil conservation and utilization consists of introductory description of each of the eight basins, defines the major terms used in the memorandum, divides erosion into 8 major classes, tabulates the magnitude of erosion by land use and acres, describes pertinent research on erosion, indicates trend in soil conservation practices, estimates the needs for resource development using the Conservation Needs Inventory as a base, delineates project needs for erosion damage reduction, estimates land uses expected to occur in 1975 and projects these data to the year 2000. Cost estimates and 16 tables relating to aspects of the soil conservation study are included.

Estimated Technical Assistance Costs in the Southeast River Basins Area, Soil Conservation Service, Athens, Georgia, August 14, 1961, 5 pp.

Describes the distribution of 550 man-years of technical assistance costs by basins for the estimated projects to be installed to the year 2000 in the study area.

Federal and State Programs Bearing Upon the Conservation, Utilization and Development of Land and Water Resources in the U. S. Study Commission, Southeast River Basins Area, Soil Conservation Service, 1960.

Describes activities and programs of eight agencies in the U. S. Department of Agriculture and four State programs concerned with the conservation, utilization, and development of land and water resources in the study area.

Cost-Return Information: attached to letters received from the following State Conservationists, Soil Conservation Service: C. A. Tidwell, New Mexico, April 16, 1962; L. G. Lloyd, North Dakota, April 19, 1962; and C. E. Mick, Illinois, April 20, 1962.

Statistical Summaries of Conservation Needs Inventory by counties, states, and physiographic regions; by basins of (a) Land Capability Units and land-use combination and by (b) soil type, slope, erosion, land-use combination, prepared for the Commission by the Statistical Laboratory, Iowa State University, Ames, Iowa.

Other selected references used:

U. S. Department of Agriculture:

Policy and Procedure for Development of National Inventory of Soil and Water Conservation Needs, Budget Bureau, No. 40-5759, August 1957.

This 26-page document discusses the objective of the inventory, defines soil and water conservation, describes the basic economic framework under which the inventory is to be developed, defines the scope of the inventory, the organization and cooperation of the eight Federal agencies primarily responsible for the inventory, establishes procedure for State and county facilities for conduct of the physical inventory, and illustrates tables for compiling data to go in the inventory. Procedure for compiling data on the following are shown: land use - present and expected changes in land use by 1975, needs for conservation treatment on expected acreage of cropland, pasture and range, forest and woodland, other land and an inventory of watershed project needs.

Inventory of Watershed Project Needs, State Summaries Form S-3-5 of Conservation Needs Inventory, States of Alabama, Florida, Georgia, and South Carolina, as of January 1, 1958.

Contains an inventory of watersheds for: (1) Flood prevention, (a) floodwater and sediment damage reduction; (b) erosion damage reduction; (2) agricultural water management, (a) drainage; (b) irrigation; (c) other; and (3) nonagricultural water management developments for water supply, recreation development, and other purposes. For each of the disciplines the acreage having the problem and acreage needing project action is shown.

Public Law 566, List of Watershed Protection and Flood Prevention Applications, States of Alabama, Flor-

ida, Georgia, and South Carolina as of January 1, 1960.

This is a list of applications submitted by local interests in those portions of each State in the study area where project action is required for solving flood prevention, watershed protection, and other problems.

Consolidated Soil and Water Conservation Research Needs Report Southeastern States, Soil Conservation Service, April 15, 1959.

Thirty-five pages are devoted to describing watershed engineering, water management, basic soil problems, erosion control, soil management, plant management, economic and social aspects of soil and water conservation, and biology research needs. Data are based on material submitted by the Research Needs Committees of nine southern States.

Economic Evaluation of Soil and Water Management Measures, Melville H. Cohee, Agricultural Economist, Soil Conservation Service; Agricultural Engineering, Vol. 40, No. 12, pp. 740-745, December 1959.

The author brings together in one package the essentials of economic evaluation of soil conservation. Items contained in the article include principles of evaluation, dollars as common denominator for costs and benefits, independent and interdependent conservation measures, time discounts, and amortization of initial cost and cites three examples of economic valuation of conservation practices.

A Method of Estimating the Economic Effects of Planned Conservation on an Individual Farm, U. S. Department of Agriculture Miscellaneous Publication No. 463, January 1942.

Georgia Conservation Needs Committee. *Georgia Soil and Water Conservation Needs Inventory*, Georgia State Soil and Water Conservation Committee, Athens, Georgia, 1962.

Alabama Conservation Needs Committee. *Alabama Soil and Water Conservation Needs Inventory*, State Soil Conservation Committee, 1961.

North Carolina Agricultural Experiment Station. *Methods for an Economic Evaluation of Soil Conservation Practices*, Station Technical Bulletin 137, January 1959.

A. J. Couto, W. W. McPherson, and Lee R. Martin describe data necessary for an economic evaluation, input data, yield estimates, cost and returns, compounded costs and returns, and conditions necessary for selected conservation practices to be profitable.

U. S. Congress, Senate. *Water Resource Activities in the United States: Land and Water Potentials and Future Requirements for Water*. Select Committee on National Water Resources, Committee Print No. 5, Washington: U. S. Government Printing Office, 1962.

Supplemental Data

The work plan for soil conservation and utilization studies, referred to earlier in this Section follows. Other pertinent data on soil conservation and utilization are contained in the files of the U. S. Study Commission, Southeast River Basins.

WORK PLAN - SOIL CONSERVATION AND UTILIZATION

(edited to delete administrative details)

I. **Introduction:** The 85th U. S. Congress enacted PL 85-850 for the purpose of providing for (1) an integrated and cooperative investigation, study and survey of eight river basins in the study area and (2) formulate a basic, comprehensive and integrated plan of development of the land and water resources within the area. This is to be accomplished in the area for several beneficial and useful purposes, including "soil conservation and utilization."

"Soil conservation and utilization" is defined as the protection, use, maintenance and improvement of the soil resources to the point where such resources can be protected and soil losses controlled or losses reduced insofar as practical to best serve the human needs.

It is intended that an harmonious interrelation of the function of soil conservation and utilization will be made with the other functions and elements listed in the Act establishing the U. S. Study Commission.

II. **Objective:** The principal purposes of the soil conservation and utilization phase of the study is to examine the present soil resources, conditions and problems, determine areas needing treatment, inventory existing and determine future needs for conservation programs and facilities, develop plans to meet the soil conservation and utilization needs within the study area and incorporate the result of such study into the comprehensive plan.

III. **Guidelines:** The soil conservation and utilization study will cover existing conditions and plans will be prepared to meet the soil conservation and utilization needs at least to the years 1975 and 2000.

The studies will probably be accomplished in phases. First, an evaluation will be made of available data such as that contained in portions of the Soil and Water Conservation Needs Inventory. Subsequently, it may be indicated that additional data is needed on some facets of the soil conservation function. Inquiries will then be made to determine the extent to which agencies, organizations or other sources can provide the data. Thereafter, it may be indicated that intensification of the detailed study will be helpful within portions of specific physiographic provinces, subbasins, or other geographical areas. If the additional detailed study appears to be warranted within given areas, then it will be accomplished within budgetary and time limitations. Such additional need determination will be done by a special study within specified geographical areas. Predeterminations will be made of such items as the estimated costs of the special study, where the study will be made, an estimate of the length of time required to complete such study and a comprehensive statement of what the special study proposes to accomplish.

On the basis of the physical data obtained and evaluated and results of soil conservation and utilization studies, report material will be prepared by the Commission staff. It is planned that all soil conservation and utilization studies will be of a quality suitable for use in formulation of the comprehensive plan.

IV. Work Outline

A. Develop standard definitions, planning criteria and units of measurement. (To be developed by sub-work group and USSC staff member)

B. Technical Tasks

1. Basic data
 - a. Inventory of soils—Existing situation, conditions and problems¹
 1. Determine and define physiographic, soil resource or soil problem areas. (USSC, USGS and SCS)
 2. Determine and define capability classes (SCS)
 - a. Land suited for cultivation and other uses. Land Classes I, II, III and IV
 - b. Land limited in use—generally not suited for cultivation. Land Classes V, VI, VII and VIII
 3. Determine and define capability subclasses (SCS)
 - a. Kinds of limitations recognized at the subclass level
 4. Determine and define capability units (SCS)
 5. Other kinds of soil groupings (SCS)
 - a. Groupings for range use, woodland use, special crops, engineering interpretation and others
 6. Compute for 1, 2, 3, 4 and 5 above the acreage, extent or location or other units of measurement by states, physiographic or problem areas and subbasins, as pertinent and needed to make determinations (Ames, Iowa Stat. Lab., SCS, Colleges)
 7. Slope and hazards of erosion (Ames, Iowa Stat. Lab., SCS, Colleges)
 - a. Slope—by percentage grouping
 - b. Location and existing extent of erosion by types
 - c. Means of controlling erosion now in use
 - d. Limitations imposed by eroded soil conditions
 8. Inventory existing land factors (SCS)
 - a. Present land use by land capability units and trends. Compute acreage of (1) cropland; (2) pasture and range; (3) forest and woodland (a) in farms or operated for production of forest products and (b) other

¹ Parts of the "National Inventory of Soil and Water Conservation Needs," for the States involved and projections will be used in developing basic data. Problems and measures concerning soil conservation on irrigated and drained lands will be included in this section; irrigation and drainage structures will be included under their respective work outlines.

- forest and woodland and (4) (a) other land in farms and (b) not in farms
- b. Evaluate present cover conditions (ARS, SCS)
- c. Evaluate present productive capacity for crops and other uses (ES, ARS, SCS)
- d. Miles of highways or other units of measurement (distinguish between Federal, Federal-State, State and other types of highways and roads) needing shoulder, cut, fill and back slope erosion control measures—describe measures needed (Bur. Pub. Roads, State Highway Boards)
- e. Total annual sediment damage to flood plain land and existing facilities by soil movement from agricultural lands, including cropland, pasture and range and other land (C of E, SCS)
 - 1. Extent of deposition of infertile material and impairment of drainage
 - 2. Damage to existing facilities such as fences, buildings, roads, highways and appurtenances thereto, utilities; reservoirs and to other facilities as determinable
- f. Obtain documentary and photographic depiction of representative soil conservation problems and methods of control (SCS, ARS, C of E)
- b. Existing Soil Conservation and Utilization Programs (From agencies or groups indicated)
 - 1. Soil conservation districts
 - 2. Soil Conservation Service
 - 3. A.C. program
 - 4. Other programs
- 2 Need for resource development
 - a. Estimates of expected changes in land use and land treatment measures for soil conservation by years 1975 and 2000 by counties, subbasins, states and SE River Basins¹ (SCS)
 - 1. Estimate of needs for conservation treatment on expected cropland acreage
 - a. Land with no problems that limit use
 - b. Land on which the dominant problem is erosion by water or wind, or both
 - c. Land on which the dominant problems are caused by unfavorable soil conditions
 - 2. Estimate of needs for conservation treatment on expected acreage of pasture and range.
 - a. Area not needing treatment or not feasible to treat
 - b. Area needing treatment
 - c. Type of problem and area affected
 - 3. Estimate of needs for conservation treatment on expected acreage of other land (such as farmsteads, idle, buildup and urban areas and other areas not classified into cropland, pasture and range, forest and woodland)
 - 4. Describe desirable land use changes
 - b. Extent of problems in (a) above involving special treatment
 - 1. Watershed project needs (SCS)
 - a. Acreage having the problem
 - b. Acreage needing project action
 - 2. Extent of accelerated land treatment measures needs for watershed protection (SCS)
 - 3. Estimate of extent of new—defense installations; roads; industrial, home and urban sites; strip mining and other specified uses. (Dept. of Defense, State Geologists, U. S. and State Departments of Commerce, Municipal Associations)
 - 4. Extent that development of such programs as irrigation, drainage and flood control may add lands not now farmed to the cropland base. (C of E, ARS, SCS, State Exper. Stations)
 - 5. Extent of creation of critical erosion problems by types of construction and other programs involving mechanical moving of soils (C of E, SCS)
 - 6. Extent of shifts to land use within its capabilities that will maintain covers of permanent vegetation on the land (SCS)
 - 7. Specify where conservation efforts should be intensified (SCS and Colleges)
 - 8. Influences conservation farming will have on production (SCS)
 - 3. Develop a soil conservation and utilization program, at least through the years 1975 and 2000 by a
 - a. Single-purpose plan²
 - b. Modified single-purpose plan³
 - 4. Develop list of technical memoranda needed in accordance with above tasks
 - C. Technical Programming
 - (Administrative details)

¹ Estimates of expected changes in land use and estimates of needs for conservation treatment on expected acreages of cropland, pasture and range and other land (other than forest and woodland) for year 1975 may be obtained from Conservation Needs Inventory. Year 2000, will be otherwise estimated.

² The single-purpose plan will present a single-purpose approach meeting the needs for resource development by the soil conservation and utilization function without consideration of other purposes or functions mentioned in the Act creating the USSC.

³ The modified plan will include or exclude elements because of institutional, legal, physiographic, physical or other reasons so as to recognize certain inevitable factors of development. When the various modified functional plans are considered in the comprehensive plan they may and probably will undergo further adjustment.

SECTION XI – FOREST CONSERVATION AND UTILIZATION

General Concept

Forest conservation and utilization studies deal mainly with the timber and gum-naval stores aspects of the overall forestry picture. Other forest uses are planned for under other purposes. To avoid areas of possible interpurpose duplication in the planning, the following decisions were made.

(1) Forest recreation would be considered as part of the recreation purpose.

(2) Forest wildlife opportunities would be considered in the fish and wildlife studies.

(3) Changes in hydrologic conditions of forest lands would be evaluated in the flood control studies.

(4) Shelterbelt planting would be included in the forestry studies.

(5) Costs and benefits of woodland water control and drainage would be included in the forestry evaluations. Estimated need for this measure would be coordinated with needs indicated in the flood control-drainage studies.

(6) Woodland range use would be accounted for in the soil conservation and utilization function but that need for fencing and other measures to control woodland grazing would be included in the forestry recommendations.

The definitions of uncommon terms used in discussing the forestry situation are as follows:

Commercial forest land—Forest land which is producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

Site class—A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Stocking—A measure of area occupancy by trees of specified classes. Three categories of stocking are considered: (1) All live trees, (2) growing-stock trees, and (3) desirable trees. Stocking in terms of all trees is used in the delineation of forest land and forest types. Stocking in terms of growing-stock trees is used in stand size and age classification. Stocking in terms of desirable trees is used in delineating area condition and stand treatment classes.

Naval stores—The derivatives of the crude gum that comes from living pine trees, pine stumps, lightwood, and byproducts from sulphate.

Gum-naval stores—Naval-stores products derived from the crude gum bled from living trees.

Wood-naval stores—Naval-stores products obtained by (1) the destructive distillation of pine wood or by the action of suitable solvents on chipped or macerated wood, or (2) the recovery of turpentine fractions or liquid rosin, tall oil from sulphate mills engaged in pulping wood of various species of pine.

Face—In gum-naval-stores production, the exposed surface of the tree from which oleoresin exudes.

Stumpage value—The value of timber as it stands uncut in the woods.

Growing stock volume—Volume of sound wood in the bale of sawtimber and poletimber trees from stump to a minimum 4.0 inch top diameter outside bark.

Prospective management—Management assumptions based on recent trends in forestry practices in the basins and judgment as to the likely course of future events.

High-level management—The application by the year 2000 on all the many ownerships in the basins of the practices now being applied on the best managed lands in the basins. This would require major improvement and protection especially on farm and other small holdings.

Work Plan

One of the first steps in planning for the forest resources of the basins was the development of a forestry work plan that outlined the (1) Purpose of the studies, (2) guidelines and criteria, (3) data needed, (4) work schedules, (5) sources of data, and (6) probable work assignments. A copy of the work plan is included at the end of this Section.

The work plan was never formally revised but certain deviations from the outline were necessary as forestry studies progressed. The principal change was the omission of work items relating to forest uses that were being considered in studies for other purposes.

Work Performance

Many agencies, organizations, and individuals helped develop material and recommendations needed to plan for the development and use of the basins forest resources. Some did work by

contract, some by agreement. Much data was voluntarily contributed. The Commission staff conducted many studies and analyses.

The State forest services undertook studies and forwarded to the Commission information on present forest conditions; present forest programs; pulp and paper, lumber and wood products, and naval stores industrial development; and need for new, revised, or accelerated programs and measures to help meet the projected production requirements.

The U. S. Forest Service undertook several studies for the Commission and provided the following:

(1) Forest area data by counties and parts of counties, by States, by physiographic provinces, and by basins. These data were used by the agricultural colleges in their compilation of basic agricultural data for 1954.

(2) Forest survey information on forest type, stocking, stand size, volume, and gum-naval store status of forest lands by States, basins, and the Blue Ridge, Piedmont, and Coastal Plain physiographic provinces. These data were used for descriptive and planning purposes.

(3) Projections of potential timber supplies and forest industrial development in the Southeast River Basins, including:

(a) Background information on the 1960 forest resource situation in the study area pertinent to the development of growth projections.

(b) Projections of potential growth and the character of the timber that might be achieved in the Southeast River Basins by 1975 and 2000 under alternative management assumptions, including a comparison with the growth needed to supply a reasonable share of the projected national demands for timber.

(c) Projected growth of forest industries measured in terms of employment, payrolls, and value added by manufacture that could be supported in Southeast River Basins by the timber growth achieved under the alternative management assumptions.

(4) A report of the programs, facilities and needs on lands administered by the U. S. Forest Service and a summary of additional forest research programs and facilities needed in the area.

(5) Studies to estimate impact of projects and programs of other functions on the forest re-

source. Work covered under this phase included evaluating the forestry portion of the multiple-purpose projects, and determining the anticipated impact upon forestry that will result from: (a) Proposed inundation projects; (b) intensive and extensive fish and wildlife programs; (c) intensive and extensive recreation use; (d) reduced flood hazards from flood control projects; and (e) drainage works of improvement.

The Business and Defense Services Administration, U. S. Department of Commerce and the Georgia Tech Research Institute made studies of the pulp and paper and the other wood product industries. Conditions, as of 1960, were inventoried and projections made for 1975 and 2000. Items covered included employment, wages and salaries, value added by manufacture, and volumes of output.

Other studies included: (1) Review by the Post Forester of present conditions and needed programs on forest lands in Fort Stewart, Georgia; and (2) forestry summaries of data included in the Conservation Needs Inventory of the U. S. Department of Agriculture.

Coordination

After the work plan was completed and the basic contracts let, the Commission consolidated material it believed would be helpful for forest resource planning. A Forestry Committee of State and U. S. Forest Service personnel was organized to give advice on the evaluation of the findings. The committee agreed on projected production needs, methods of meeting the needs, methods of presenting findings, forestry measure costs, and value of forest products. Costs and value of forest products were considered on an early 1960 price level.

Contacts with other than committee members were frequently made during the course of study to obtain group and individual viewpoints and thus help insure that a comprehensive plan would be formulated. The desires and viewpoints of the varied forestry interests were considered although their ideas could not always be included in the plan. The contacts also made it possible for the Commission to keep forestry interests informed of the progress of the studies.

The Land, Water, and Economics Groups also considered the forestry aspects during their deliberations. It was also recognized that certain

projects or programs for one purpose would nearly always affect other purposes. However, it was decided that unless substantial benefits accrued to the other purposes, all costs for projects or programs would be allocated to the primary intended purpose.

For example, intensified forest fire protection was recommended primarily for timber production. However, wildfire protection also benefits fish and wildlife habitat, protects recreation areas, and helps maintain watershed conditions. Benefits other than for timber production were minor and no attempt was made to allocate benefits and costs. Costs were considered entirely as a forestry purpose cost.

Findings

Needed Production

Projected requirements for wood and gum-naval production were based on allocating a portion of projected national needs to the Southeast River Basins where timber growing and market conditions are particularly favorable. The U. S. Forest Service undertook a study to determine the share of the needed national wood growth in 2000 which might be reasonably allocated to the Southeast River Basins. Their findings are included in the report entitled, "Potential Timber Supplies and Forest Industrial Development in the Southeast River Basins." The Commission revised these estimates to reflect Commission assumptions on projected population, gross national product, and woodland acreage that were different than those used by the Forest Service.

TABLE 2.40
Needed and Projected Wood Growth
in Year 2000
(millions of cubic feet)

Kind of timber	Needed growth	Projected growth	
		With prospective management	With high-level management
Growing stock			
Softwoods	1,600	1,200	1,600
Hardwoods	600	500	700
Total	2,200	1,700	2,300

Annual naval-stores-production requirements for the future are not expected to increase during the next 40 years. Sources of naval-stores produc-

tion are expected to change, however. As suitable areas of stumpwood are depleted, other sources of naval stores will need to replace this currently available source.

The recovery of turpentine fractions and tall oil from sulphate pulping mills is approaching maximum from existing mills and increased production of naval stores from this source will depend mainly on new mills or expansion of existing mills. Gum-naval stores are expected to be the principal source of replacement for wood-naval stores obtained from stumpwood and production of gum-naval stores will need to double by the year 2000 to maintain current overall naval-stores production.

TABLE 2.41

Estimated Number of Faces Worked in 1959
and Projected Needs by 2000, by Basins
(thousands of faces)

Basin	Faces worked	
	1959	2000
Savannah	260	520
Ogeechee	1,871	3,742
Altamaha	8,891	17,780
Satilla-St. Marys	6,400	13,000
Suwannee	7,000	14,000
Ochlockonee	560	1,120
A-C-F	640	1,280
Choctawhatchee-Perdido	815	1,630
Total	26,437	53,072

Woodland Area

The Commission developed estimates of present and projected woodland acreages using data and information from many sources.

TABLE 2.42

Estimated 1959 and Projected 1975 and 2000
Woodland Areas by Basins
(thousands of acres)

Basin	Woodland area ¹		
	1959	1975	2000
Savannah	4,508	4,500	3,899
Ogeechee	2,242	2,351	2,174
Altamaha	6,847	6,451	5,714
Satilla-St. Marys	2,716	2,713	2,550
Suwannee ²	4,705	4,838	4,477
Ochlockonee	3,056	3,027	2,837
A-C-F	8,169	7,841	6,123
Choctawhatchee-Perdido	6,629	6,583	5,885
Total	38,372	38,304	33,659

NOTES: ¹ Excludes small water bodies.

² Excludes 331,000 acres in Okefenokee Swamp.

Approximately 185,000 acres of woodland were classed as noncommercial in 1959. These lands had a tree canopy but were either used for other purposes that precluded harvesting the timber or were considered incapable of growing merchantable timber. About 103,000 acres of non-commercial woodland were in the Florida portion of the Southeast River Basins, 72,000 acres in Georgia, 8,000 acres in South Carolina, and 1,000 acres each in Alabama and North Carolina.

Productive Capacity, Growth, and Growing Stock on Commercial Woodland

The classification of forest site, like many other forest classifications, was based on an analysis of plot data collected and compiled as part of a continuing survey of forest lands throughout the Nation. The U. S. Forest Service conducts these surveys but the States and forest industries co-

operate and participate fully. Table 2.43 gives estimates of forest areas by site classification.

Minor adjustments were made to the forest survey data to adjust to the 38,186,000 acres of total commercial woodland estimate adopted by the Commission.

The present and future estimated average net growth per acre for the three site classes as determined by the U. S. Forest Service is shown in Tables 2.44, 2.45, and 2.46.

Volume of growing stock on commercial forest lands was determined from forest survey data. The Commission adjusted estimates provided by the U. S. Forest Service to reflect the minor differences in acreage assumptions of the two agencies. Table 2.47 presents these revised estimates.

The Forestry Committee at the March 28,

TABLE 2.43
Commercial Woodland in the Southeast River Basins, 1959
(thousands of acres)

Basin	Total area	Uplands and flatwoods			Bottom lands		
		Total	Site class		Total	Site class	
			Good ¹	Fair ²		Good ¹	Fair ²
Savannah	4,490	3,774	1,568	1,550	656	716	348
Ogeechee	2,203	1,598	865	482	251	605	120
Altamaha	6,341	5,086	2,687	1,769	630	1,255	477
Satilla-St. Marys	2,709	2,217	1,522	487	208	492	94
Suwannee	4,680	3,306	1,999	1,023	284	1,374	385
Ochlockonee	3,000	2,082	1,015	690	377	918	211
A-C-F	8,144	6,731	3,016	2,430	1,285	1,413	482
Choctawhatchee-Perdido	6,619	5,624	2,050	2,040	1,534	995	680
Total	38,186	30,418	14,722	10,471	5,225	7,768	2,417
							4,542
							809

NOTES: ¹ Sites capable of producing 85 or more cubic feet per acre annually.

² Sites capable of producing 50 to 85 cubic feet per acre annually.

³ Sites capable of producing less than 50 cubic feet per acre annually.

TABLE 2.44
Average Net Growth per Acre of Growing Stock
on Commercial Woodland in the Southeast River Basins, 1960
(cubic feet)

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Good	48	42	6	58	10	48
Fair	23	18	5	33	7	26
Poor	11	9	2	18	5	13
Basins average	33	28	5	39	8	31

1961, meeting concurred in average unit cost estimates for most of the general forestry measures. The committee also recognized that there could be a wide range in unit costs for some of the measures.

Some cost data were supplied by cooperators on the basis of inventories of needs which were available. In these cases unit costs were not supplied, but instead total costs of projects and programs were presented.

TABLE 2.45
Projections of Average Net Growth per Acre with Prospective Management for Growing Stock on Commercial Woodland in the Southeast River Basins, 2000
(cubic feet)

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Good	63	54	9	57	7	50
Fair	47	39	8	50	7	43
Poor	18	14	4	32	6	26
Basins average	50	42	8	50	7	43

TABLE 2.46
Projections of Average Net Growth per Acre with High-Level Management for Growing Stock on Commercial Woodland in the Southeast River Basins, 2000
(cubic feet)

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
Good	84	73	11	70	6	64
Fair	64	54	10	66	5	61
Poor	32	27	5	46	5	41
Basins average	68	59	9	65	5	60

TABLE 2.47
Volume of Growing Stock on Commercial Woodland in the Southeast River Basins, 1960
(millions of cubic feet)

Basin	Total volume			Uplands and flatwoods			Bottom lands		
	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods
Savannah	2,648	1,410	1,238	2,043	1,346	697	605	64	541
Ogeechee	1,226	698	528	762	638	124	464	60	404
Altamaha	3,725	2,253	1,472	2,678	2,136	542	1,047	117	930
Satilla-St. Marys	1,748	1,354	394	1,324	1,231	93	424	123	301
Suwannee	2,647	1,942	705	1,657	1,544	113	990	398	592
Ochlockonee	1,779	1,052	727	968	817	151	811	235	576
A-C-F	3,702	1,849	1,853	2,432	1,655	777	1,270	194	1,076
Choctawhatchee-									
Perdido	3,175	1,773	1,402	2,234	1,618	616	941	155	786
Total	20,650	12,331	8,319	14,098	10,985	3,113	6,552	1,346	5,206

TABLE 2.48
Unit Costs of Certain Forestry Measures,
1960 Prices

Measure	Average unit cost
Forest fire protection	Based on State reports
Fencing for grazing control	\$300 per mile
Erosion control tree planting	\$25 per acre
Planting without site preparation	\$14 per acre
Planting with site preparation	\$28 per acre
Site preparation for natural reproduction	\$5 per acre
Noncommercial thinning and deadening	\$8 per acre
Shelterbelts	\$15 per acre
Technical assistance ¹	\$10,000 per man-year
Drainage (including roads)	\$12 per acre
Research ²	\$15,000 per man-year
Insects and disease ²	\$15,000 per man-year
Information and education ²	\$10,000 per man-year

NOTES: ¹ Includes allowance for travel, office space, and overhead. An additional \$2,200 will be allowed for first year equipment costs.

² Includes associated costs and clerical help.

Benefits or Returns

Stumpage value of standing timber that would be cut and net leasing value of trees to be worked for gum-naval stores were considered in evaluating benefits for the forestry program.

A 10-cent value, 1960 price levels, was established for a cubic foot of wood on the stump. Rounded estimates of (1) distribution of harvest into products, (2) stumpage value of the different types of material, and (3) the cubic foot content of the selling unit were the items considered in setting up this value. The stumpage value of products considers both hardwoods and softwoods and the unit value would apply to all wood harvested.

An average \$0.25 per year leasing value per face was estimated for pine trees to be worked for gum-naval-stores production. An annual reduction of wood growth equivalent to \$0.05 per face to be worked was also estimated. Net leasing

value of the increased number of faces on pine trees needed to meet production requirements was then computed to be \$0.20 per face per year.

Alternatives

There are many possible ways of producing the amounts of wood and naval stores required in the future. Total and site quality acreage adjustments could be made but the estimated woodland areas were established at the beginning of the studies. Some changes may occur in the area expected to be devoted to forestry purposes and some land use adjustments may be made affecting forest site quality. However, these possible changes would generally be minor and would not significantly affect planning. The intensity of application of recommended forestry measures would affect future production. The combination of measures and the intensity of each that would provide needed production and gave the greatest returns at least cost were considered for the plan.

Trends in Timber Growth

In recent years, tree stocking and growth of both softwood and hardwood timber have been increasing as a result of substantial improvements in forest practices in the Southeast River Basins area. Thus, between 1950 and 1960, net annual growth of softwood growing stock increased 5 percent and hardwood growing stock, 6 percent. Growth of softwood sawtimber, however, showed a 4-percent drop as the result of heavy cutting pressures on the larger sizes of softwood timber. There was practically no change in the growth of hardwood sawtimber.

Better fire protection probably has been the most influential single factor explaining the rise in timber stocking and timber growth. Practically all the commercial forest area in the basins has been under organized fire protection for at

TABLE 2.49
Derivation of the Value of a Cubic Foot of Wood

Item	Percent of harvest	Unit of measurement	Value per unit	Cubic feet per unit	Value per cubic foot	Weighted value
Pulpwood	50	cord	\$5.50	75	\$0.073	\$0.037
Sawlog	50	1,000 bd. ft.	25.00	200	0.125	0.063
Weighted average						0.100

least 10 years and most of the area for at least 20 years. An increase in average pine stocking from 40 to 50 percent in pine types, in spite of the increased hardwood encroachment in pine stands following fire protection, largely reflects the reduction of the frequent and extensive wildfires that formerly killed millions of young trees annually and kept a large part of the area poorly stocked.

Extension of improved gum turpentining practices, along with a sharp cutback in the number of pine trees worked, has also contributed to improved forest conditions. Much woods burning in the past was done to keep stands clear of underbrush to facilitate turpentining and this served to keep extensive forest areas well below optimum density for timber production. Also fires were commonly allowed to spread to other stands where most of the young trees were killed before they became large enough to resist fire. Prior to the adoption of improved turpentining practices, the butt sections of turpentined trees were usually unusable, and turpentined stands often did not have enough usable material to justify cutting for saw logs which at that time was virtually the only market for pine. For the most part these stands were left to the ravages of fire, wind, and insects, and mortality in the early 1940's consequently was several times what it is today.

Formerly, a great deal of woods burning was done in an attempt to improve forage for cattle. Today increased dependence upon improved pastures and high-grade stock has eliminated a good deal of such woods burning.

Increased planting also has contributed to increased pine stocking and in time will result in a substantial rise in volume growth. The number of pine seedlings distributed in the basins area jumped from an estimated 79 million in 1950, for example, to 466 million in 1959. Forestry practices such as chemical control of hardwoods and site preparation with heavy machinery have shifted from an experimental to a production basis since 1950. In recent years thousands of acres of scrub oak and other low-grade hardwoods have been bulldozed and piled in windrows, and the cleared areas planted to pine.

Considerable areas also have been covered by timber-stand improvement programs under which cull trees and other hardwoods have been

killed to permit growth of pine timber. The full contribution of these planting and timber-stand improvement programs will not be fully realized in terms of timber growth for another 20 to 30 years, but these contributions will be substantial.

Outlook for Timber Growth

Estimates of the timber growth that might be achieved in the Southeast River Basins by 1975 and the year 2000, assuming (a) prospective changes in forest management and (b) high-level management were made.

Although both projections indicated the likelihood of substantial increases in the availability of timber over the next four decades, projected needs for wood indicated that high-level management would be required to meet projected goals.

Projections of growth over the next several decades were made by estimating the changes in the various factors affecting growth that would be likely to occur. These include changes in prospective stocking, radial growth, mortality, net volume per tree, and timber cut. The areas covered by the specific management measures that might reasonably be expected to result in these changes in growth factors were then estimated. Assumptions affecting growth factors under high-level management were:

Stocking—It is estimated that stocking would increase from an average of 49 percent in 1960, 36 percent softwoods and 13 hardwoods, to about 79 percent by the year 2000, 59 percent softwoods, and 20 percent hardwoods.

Stand structure—Assumptions as to prospective numbers of trees by diameter classes are considered to be of particular importance in determining rotation age and the consequent size of timber likely to be available to forest industries. Stand structure is expressed in terms of ratio between the number of trees in a 2-inch diameter breast high class and the amount and character of timber growth, especially ingrowth. If past trends are maintained, this ratio would continue to rise markedly, with continued reductions in the average size of timber available in the area. It is assumed, however, that the current stand structure with a rotation age of about 40 years on average sites will be maintained in the future.

Mortality—It is assumed that softwood mor-

tality would drop from the present level of about 11 percent of gross growth to 5 percent by the year 2000, while hardwood mortality would drop from 15 percent at present to 10 percent by the year 2000. These reductions would come in part from better protection but mainly from anticipation of mortality in thinning and stand improvement operations and from more complete salvage of dead timber.

Radial growth and tree volumes—It is assumed that radial growth of trees might increase an average of 10 percent. Such increases would be expected to result from more favorable spacing and density of stands with resulting increases in vigor and growth rates.

It is assumed that the average volume per tree grown in the year would increase 10 percent over current average volumes. This increase would be a consequence of stand improvement and thinning operations which would leave the taller and less defective trees in the stands.

Cutting—It is assumed that the cut of timber products would be equal to growth in the year 2000, but that during the intervening years timber cut would be somewhat less than the growth. In 1960 the cut of softwoods was about 96 percent of growth and the cut of hardwoods about 77 percent of growth.

Estimates of projected growth, as in the case of current growth, emphasize the major importance of site quality in timber production and management programs. The concentration of timber growth on the better sites pinpoints the desirability of maintaining the higher sites in timber production to the extent feasible, and minimizing the transfer of such lands to non-timber uses.

The growth projections under high-level management assumptions should not be regarded as an absolute ceiling of growth that could be achieved during the period of projection. Earlier and/or more intensive application of management practices than assumed, or lower rates of cutting than assumed, could result in higher trends of growth to the year 2000. Too, research findings particularly in the field of genetics could increase growth potentials. Improved planting stock, superior trees, disease resistant species, and high gum producing strains will undoubtedly make it easier to reach projected wood and gum-naval stores production goals by the year 2000.

As indicated earlier, growth projected under high-level management assumptions will just about meet the need for wood production in the year 2000. Therefore, forestry program needs estimates provided by the State and Federal forest services for high-level management are included in the plan. Because of the nearly comparable projections of needs and growth, it was necessary to plan an intensive program for all lands and not concentrate on the better sites or lands under enlightened ownerships.

Certain modification of forestry measure needs were made, however, and the revisions were concurred in by the Forestry Committee. It was recognized that all forestry owners would not participate in the plan and that some would only engage partially. To account for this lack of participation, a reduction of 25 percent was made for those measures requiring general participation by all woodland owners. It is thought that the loss of projected annual growth due to nonparticipation will be offset by the gradual application of research findings. The Forestry Committee agreed that improved utilization, superior trees, and improved harvesting techniques could make up the deficit that might be anticipated if all woodland owners did not carry out the programs indicated as being needed for high-level management.

Special Studies

Special studies were made to determine the effect of recreation, grazing, woodland drainage and flood protection, and wildlife management programs on commercial woodland production. The findings are as follows:

Recreation—Intensively used recreation areas for all intents and purposes can be ruled out as wood producing areas in a forest management plan. If a block of timber within a recreation area is not subject to the intensive use that camping and picnicking bring, then it can be included in management plans. Roadside picnic areas, which are small in size, need not be deleted from forest management plans. Greater care will, however, have to be exercised in the selection and cutting of trees in the above mentioned areas than in forested areas not subject to the use of the public. Wilderness areas, as the term implies, means leaving the forest land unchanged by man. These areas can, therefore, be ruled out

as producers of wood from forest management plans.

Intensively managed wildlife areas—Forest areas managed intensively for wildlife will require favoring hardwoods, many of which are not valuable commercially. In addition, numerous openings will have to be created in the forest for wildlife food production. Intensive management for wildlife production will reduce wood production by approximately 10 percent.

Extensively managed wildlife areas—An extensively managed forest wildlife area is compatible with only slight modification with timber production. No significant loss in wood production is seen on areas so managed.

Controlled and uncontrolled grazing—Grazing is detrimental to hardwood reproduction. Timber stands being managed for commercial hardwood production furnish a meager amount of usable forage through most of their rotations. Controlled seasonal grazing in pines is compatible with timber production. Uncontrolled grazing in pines may totally destroy reproduction as well as reduce growth. Uncontrolled grazing can reduce the effectiveness of a forested watershed. Woodland grazing should be controlled and kept in balance with available forage. Where improved feed production areas are not available and yearlong woodland grazing must be practiced, supplemental feeding areas should be dispersed to minimize soil compaction, damage to tree reproduction, and wildlife habitat.

Woodland drainage—Poor growth rates and inadequate reproduction on most ponded sites are caused by both flooding and inadequate drainage. Drainage benefits were not determined separately from flood control benefits for these sites and an arbitrary division of benefits was made. It is estimated that the net annual benefits from combined drainage and flood prevention to woodland areas needing treatment will average about \$5 per acre.

Flood protection—Flooding, which usually occurs in the dormant season, offers little detriment to forest growth. It may even be beneficial to growth by building up soil moisture. When an area floods but has no adequate outlet, damage to tree growth results.

Inundation—Onsite studies of woodland that would probably be inundated by proposed reservoirs were made. Estimates of the gross and net

value of the loss of woodland production were made for each site. Expected management levels were projected for the evaluation period and wood stumps and gum-naval stores leasing values were considered. Deferred returns and costs were discounted to a common time base. The average gross annual equivalent value of the loss of production at reservoir sites ranges from about \$4 per acre to \$15 per acre. Net annual equivalent values of loss of production range from about \$1 per acre to about \$8 per acre. Amortization of needed investment costs and interest on the value of the existing growing stock were considered in arriving at the net values.

Single-Purpose Plan

Because of the limited overlap between the forestry purpose and the other purposes, the single-purpose plan is, in essence, the comprehensive plan. Projections of future forest land acreages considered loss of forest land to other purposes and uses and single-purpose forestry planning centered on the projected forest acreages.

Comprehensive Plan

The comprehensive plan includes forestry development to meet the estimated 2000 needs of 2.2 billion cubic feet of wood production and the maintenance of current naval-stores output. The following tables summarize the key benefit, cost, and production requirement determinations.

TABLE 2.50
Wood Harvest by Basins – 1959 and
Projected 2000
(millions of cubic feet)

Basin	Wood harvest	
	1959	2000
Savannah	107	252
Ogeechee	56	141
Altamaha	166	386
Satilla-St. Marys	76	180
Suwannee	130	305
Ochlockonee	74	181
A-C-F	199	394
Choctawhatchee-Perdido	146	361
Total	954	2,200

TABLE 2.51
Summary of Forestry Benefits and Costs by Basins - 1960 Price Levels
 (thousands of dollars) |

Basin	Total program			Early action investment costs	OM&R costs at year 2000
	Benefits Annual equivalent	Costs Annual equivalent	Investment		
Total	Total	OM&R			
Savannah	5,039	3,438	1,214	92,080	52,450
Ogeechee	3,182	1,526	706	34,730	16,220
Altamaha	8,440	2,935	905	90,300	35,000
Satilla-St. Marys	4,051	1,989	880	46,650	22,570
Suwannee	6,733	3,889	1,774	86,840	45,820
Ochlockonee	3,839	2,922	1,315	64,940	39,780
A-C-F	5,715	4,331	1,371	127,800	56,520
Choctawhatchee-Perdido	7,402	3,866	1,562	100,100	42,330
Total	44,401	24,896	9,727	643,440	310,690
Rounded	44,400	24,900	9,725	643,400	310,700
					12,460

TABLE 2.52
Summary of Forestry Investment Costs, Total Program,
by States and Basins - 1960 Price Levels
 (thousands of dollars) |

Basin	Investment costs total program					
	Alabama	Florida	Georgia	North Carolina	South Carolina	Total
Savannah	0	0	53,910	2,110	36,060	92,080
Ogeechee	0	0	34,730	0	0	34,730
Altamaha	0	0	90,280	0	0	90,280
Satilla-St. Marys	0	10,960	35,690	0	0	46,650
Suwannee	0	46,390	40,450	0	0	86,840
Ochlockonee	0	56,960	7,980	0	0	64,940
A-C-F	16,100	20,860	90,840	0	0	127,800
Choctawhatchee-Perdido	53,850	46,250	0	0	0	100,000
Total	69,950	181,420	353,880	2,110	36,060	643,420

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

Florida Forest Service. *Forestry Information Southeastern River Basins, Florida*, John A. Butz and R. A. Bonninghausen (separate reports by basins and a State summary)

Basin #4 (Satilla River)—September 1960
 Basin #5 (Suwannee River)—November 1960
 Basin #6 (Ochlockonee River)—December 1960
 Basin #7 (Apalachicola River)—April 1961
 Basin #8 (Escambia River)—February 1961
 Southeastern River Basins Area—June 1961

Georgia Forestry Commission. *Information on Forestry for the Report in Georgia*, William H. McComb and John R. Burns, Jr. (separate reports by basins)

Savannah River Basin

Ogeechee River Basin
 Altamaha River Basin
 Satilla River Basin
 Suwannee River Basin
 Ochlockonee River Basin
 Apalachicola River Basin

South Carolina State Commission of Forestry. *Forestry Information Southeastern River Basin, Savannah River, South Carolina*, E. L. Middleswart and E. C. Pickens, April 1961.

U. S. Department of Agriculture. *Potential Timber Supplies and Forest Industrial Development in the Southeast River Basins*, U. S. Forest Service, Washington, 1961.

Other references used:

Alabama Conservation Needs Committee. *Alabama Soil and Water Conservation Needs Inventory*. State Soil Conservation Committee, 1961.

Alabama Department of Conservation. Report for Fiscal Year October 1, 1959—September 30, 1960.

Directory of Wood Using Industries in Georgia (second edition). Compiled by Joseph R. Saucier and Rufus H. Page, Georgia Forestry Commission and Southeastern Forest Experiment Station, Macon, Georgia, April 1959.

Emory University. *The Place of the Pulp and Paper Industry in the Georgia Economy*, Studies in Business and Economics No. 8, School of Business Administration, Atlanta 1958.

Florida Forestry Council. *Florida's Forests*, published by the Florida Forestry Association, May 1957.

Florida Forest Service. *1960 Florida Commodity Drain Report and Directory of Primary Wood Using Industries*, Tallahassee, Florida, February 1962.

Forest Farmer-Ninth Manual Edition, Vol. XX, No. 7. Edited by J. Walter Myers, Jr., Forest Farmers Association Cooperative, Atlanta 1961.

Georgia Forest Research Council. *Annual Report 1961, The Role of Forest Research*, Macon, Georgia.

Georgia Forest Research Council. *Survey of Wood Residue in Georgia*, by Rufus H. Page and Joseph R. Saucier, Resource-Industries Series Number 1, December 1958.

In the South the Woods are Full of Prosperity, Southern Pulpwood Conservation Association, Atlanta, Georgia.

Panshin, A. J.; Harrar, E. S.; Baker, W. J.; and Proctor, P. B. *Forest Products*, New York; McGraw-Hill Book Company, Inc., 1950.

South Carolina Development Board. *Industrial Directory of South Carolina, Forest Products*, excerpt from Bulletin No. 5 (Revised), Columbia, South Carolina, January 1957.

South Carolina Sawmill Information and Directory (1958 data) Information Assembled by Clemson College Extension Service and the South Carolina Commission of Forestry.

Southern Pulp and Paper Manufacturer—23rd Annual Review Number, Vol. 24, No. 10, Atlanta: October 1, 1961.

U. S. Department of Agriculture:

Timber Resources for America's Future, Forest Resource Report No. 14, U. S. Forest Service, Washington: U. S. Government Printing Office, 1958.

1960 at the Southern Forest Experiment Station, U. S. Forest Service, 1961.

1960 Annual Report of the Southeastern Forest Experiment Station, U. S. Forest Service, Asheville, North Carolina.

Forest Statistics for Alabama, Forest Survey Release 73, Southern Forest Experiment Station, U. S. Forest Service, New Orleans, Louisiana, 1953.

North Carolina's Timber Supply, 1955, Forest Survey Release No. 49 by Robert W. Larson, Southeastern Forest Experiment Station, U. S. Forest Service, March 1957.

South Carolina's Timber, Forest Survey Release No. 55 by Robert W. Larson, Southeastern Forest Experiment Station, U. S. Forest Service, Asheville, North Carolina, August 1960.

Florida's Timber, Forest Survey Release No. 57 by Robert W. Larson and Marcus H. Goforth, Southeastern Forest Experiment Station, U. S. Forest Service, Asheville, North Carolina, May 1961.

Forest Statistics for Georgia, 1951-53, Forest Survey Release No. 44 by J. F. McCormack and James W. Cruikshank, Southeastern Forest Experiment Station, U. S. Forest Service, Asheville, North Carolina, November 1954.

Woodpulp Mills in the United States by State and Type of Products, Forest Service, Washington, August 1959.

1959 Pulpwood Production in the South, by A. S. Todd, Jr., and Agnes C. Nichols, Forest Survey Release 56, Southeastern Forest Experiment Station, Asheville, North Carolina, 1960.

The Demand and Price Situation for Forest Products, U. S. Forest Service and Commodity Stabilization Service, November 1959.

Supplemental Data

The Work Plan—Forest Conservation and Utilization is attached. Other forestry data and details are included in the files of the Commission.

WORK PLAN — FOREST CONSERVATION AND UTILIZATION

(edited to delete administrative details)

I. *General* — Public Law 85-850 requires (1) an investigation, study and survey and (2) a comprehensive and coordinated plan for forest conservation and utilization. The over-all plan developed by the U. S. Study Commission will accordingly cover all aspects of forest conservation and utilization. Forestry developments will be included to the degree that they are justified and will recognize need for all forest resources and uses. Some forestry functions will be best accomplished by a single-purpose program or plan of development but most will be included in a multiple-purpose plan.

II. *Purpose* — It is intended that all phases of forest conservation and utilization be considered in developing a comprehensive plan that will insure an adequate supply of forest resources for the years 1975 to 2000. The plan will include recommendations that will allow for orderly and timely development and will provide for forest production and forest use.

III. *Guidelines* — Forest conservation and utilization as used in the U. S. Study Commission work is defined as the protection, use, maintenance and improvement of forest resources to provide adequate food, fiber and other forest products as well as recreation and wildlife resources for public and private interests both now and in the future. An inventory of resources and present developments as well as forestry programs now underway will be undertaken and will be carried to the degree of detail that is prevalent and standard in the forestry field. Estimate of future needs for each forest resource will be based upon the present and projected population and the estimated unit consumption per person in the Southeastern River Basins area and in the nation when appropriate. Industrial development required to meet the needs of the people for forest products will also be studied.

Although forest conservation and utilization includes a number of broad fields, forestry studies will be focused upon the need for forest products. Recreation, wildlife, range and other aspects of forest conservation will be covered in conjunction with other functional studies.

Recommendations and reporting on needs for forest products will be on a scale and level that will enable broad planning. Forest conditions will be inventoried by forest type, stand size, stocking and quality and the average volume of growing stock for each category will be determined. This characterization will provide sufficient detail to facilitate planning for possible remediable programs to increase the resource if projections indicate that additional forest products will be needed.

IV. Work Outline —

- A. Definitions and Criteria
- B. Inventory of forest resources including description, photographs, maps and charts
 - 1. Forest distribution, composition and change between recent surveys
 - a. Physiographic provinces
 - b. Subbasins
 - c. States
 - 2. Forest land ownership, condition, management and problems
 - a. National forest land
 - b. Other Federal land
 - c. State and local government lands
 - d. Industrial forest land
 - e. Farm woodland
 - f. Other private holdings
 - 3. Contribution of forest land by units and/or dollar value
 - a. Water regulation and soil erosion control
 - b. Timber production
 - c. Forest recreation and wildlife
 - d. Forest range
 - e. Wind breaks
 - f. Naval stores
 - g. Industrial development
- C. Existing Forest Resource Development Programs
 - 1. National forests
 - 2. Other Federal lands
 - 3. State and local government lands
 - 4. Private lands
 - a. Public programs
 - 1. Cooperative forest fire protection
 - 2. Education
 - 3. Technical assistance
 - 4. Planting stock
 - 5. ACP program
 - 6. Soil bank
 - 7. Cooperative insect and disease protection
 - b. Private forestry undertakings
 - 1. Industry assistance to other private owners
 - a. Technical assistance
 - b. Planting stock
 - c. Education
 - d. Fire protection

- 2. Consultant foresters
- 3. Forestry associations
- 5. Watershed programs — Extent of authorized forestry program by watersheds
- 6. Forest Research for all lands
 - a. Public programs
 - 1. Federal forest and range research
 - 2. Agricultural experiment stations
 - 3. State forest service
 - b. Private research
 - 1. Foundations
 - 2. Industry
- 7. Forest Education Facilities
- D. Need for Forest Resources (Years 1975 and 2000) in Basin and Nationally
 - 1. Basis of projected needs
 - a. Projected population
 - b. Unit utilization
 - c. Anticipated level of economy
 - 2. Types of use
 - a. On site
 - 1. Forage
 - 2. Watershed management
 - 3. Recreation
 - 4. Hunting and fishing
 - b. Off site
 - 1. Home
 - 2. Farm
 - 3. Industry
- E. Develop programs to meet needs for forest resources
 - 1. Study trends and estimate effects of going programs
 - 2. Determine additional forest resources required over and above that which will be available under current levels of resource development
 - 3. Plan for "ideal" functional program for each forest resource
 - a. National forest lands
 - b. Other Federal lands
 - c. State and local government lands
 - d. Private lands
 - 1. Protection from fire
 - 2. Protection from insects and disease
 - 3. Improvement in range management
 - 4. Improvement in harvesting and management
 - 5. Expanded planting program
 - 6. Reduction of flood and sediment damage
 - 7. Protect productivity of land
 - 8. Additional windbreak planting
 - 9. Increased forest credit opportunities
 - 10. Land use adjustments
 - 11. Improve recreation and wildlife resources
 - 12. Forest fire insurance
 - 13. Educational activities
 - 4. Plan for "Modified" functional forestry program
 - a. National forest lands

- b. Other Federal lands
- c. State and local Government lands
- d. Private lands
 - 1. Protection from fire
 - 2. Protection from insects and disease
 - 3. Improvement in range management
 - 4. Improvement in harvesting and management
 - 5. Expanded planting program
 - 6. Reduction of flood and sediment damage
 - 7. Protect productivity of land
 - 8. Additional windbreak planting
 - 9. Increased forest credit opportunities
 - 10. Land use adjustments
 - 11. Improve recreation and wildlife resources
 - 12. Forest fire insurance
 - 13. Educational activities
- 5. Consider legislative means of meeting objectives
 - a. Land zoning
 - b. Approaches leading to improved cutting practices
 - c. Public acquisition or leasing
 - d. Repeal of state laws limiting ownerships
 - e. Revise forest tax laws
 - f. Additional incentive payments
 - g. Providing for additional forestry educational facilities
- 6. Recommend needed research in all forest resources fields to help meet basin objectives i.e., woodland drainage, superior seed tree, genetics and improving wood utilization possibilities.
- F. Prepare technical memoranda to adequately explain procedures used in developing tasks itemized in work outline.
- G. Technical Programming (Administrative details)

SECTION XII – FISH AND WILDLIFE

General Concept

The approach followed in conducting fish and wildlife studies is in accordance with the Commission established concept that the ultimate aim of river basin projects and programs, in common with all other productive activity, is to satisfy human needs and desires, and that the goods or services produced by a project or program have value only to the extent that there will be a need and demand for the product.

The principal needs for fish and wildlife are for hunting and sport fishing, and for food, furs, oils, fertilizer, fish bait, and other industrial products. In considering these needs, fish and wildlife studies are oriented toward the people.

Work Plan

The scope of the work required is described in the work plan which is at the end of this Section.

The fish and wildlife studies are extensive rather than intensive in nature. A framework is established, however, within which more detailed studies can be conducted.

As a guide to the cooperating agencies, the studies are broken down into eight principal tasks which are set forth in detail in the technical supplement to the work plan at the end of this section. Within this framework, procedures were devised for collecting and assembling the required information.

The preparation of standards and definitions under Task 7 is particularly significant to the successful execution of the fish and wildlife studies inasmuch as separate studies were undertaken by ten different interests representing six different agencies. A total of 46 technical memorandums was received and consolidated into eight reports. A partial list of standards supplied the cooperating agencies is as follows: (1) Survey methods, (2) standard tables, (3) standard maps, (4) evaluation standards, and (5) definition of terms. A bibliography of reference material was also made available. In addition the cooperators were provided with a series of staff papers dealing with such subjects as measurement of demand for hunting and fishing opportunity and measurement of habitat capacity.

The standards, and how they were prepared and employed, are discussed in more detail under Findings.

One example of a special study undertaken under Task 8 was the work performed by Crossley S-D Surveys, Inc. This involved an analysis of data compiled for the 1955 National Fishing and Hunting Survey as applicable to the study area.

Another example was the technical memorandum concerning mourning doves prepared by the Wildlife Management Institute. This Report contains estimates of the total dove population and dove harvest in the study area by hunters. Conclusions are drawn concerning the potential

harvest and user-days hunting the population could sustain, and measures recommended for the conservation of this resource.

Work Performance

Contracts or agreements with State and Federal agencies were executed in the latter part of fiscal year 1960 for performance of studies described in the work plan. The results of studies undertaken are reported in technical memoranda. Data contained in the technical memoranda are consolidated into a special studies memorandum by the Bureau of Sport Fisheries and Wildlife. Standard tables and illustrations

agreed upon at the onset of the investigation are employed. With appropriate review and revision, this report served as the functional memorandum for reference use in formulating both the single-purpose fish and wildlife plans and the comprehensive plans for land and water resource development.

The technical memorandums prepared by the cooperating agencies were submitted in accordance with an established schedule.

An outline of narrative data contained in the technical memorandums, supporting material, and agencies and interests responsible is depicted in the following tabulation:

Steps	Standard tables		Standard maps		Cooperating	
	No.	Title	No.	Title	Agency*	Interest
1. Describe the setting						
a. Land and water	1	Land and water areas by type			All	All
b. Physiographic provinces			1	Cover and installations	All	All
c. Economic pattern	2	Population projections				
2. Measure demand for						
a. Food	3	Demand for seafood			BCF	Comm. fish
b. Raw materials	3a	Demand for industrial fishes			"	" "
	3b	Demand for fur			BSF&W	Wildlife
c. Hunting	4	Demand for hunting			BSF&W & States	Wildlife
d. Fresh-water sport fishing	5	Demand for fishing in fresh water			States	Sport fish
e. Salt-water sport fishing	6	Demand for fishing in salt water			BCF	" "
3. Measure supply of						
a. Wildlife resources	7	Extent of wildlife habitat, game populations, harvest, hunting effort, and value in 1955	2	Map showing distribution and relative abundance of deer, turkey, waterfowl, etc.	BSF&W & States	Waterfowl Wildlife
b. Sport fisheries (fresh water)	8	Extent of fishing water, fishing effort, and value by type in 1955	3	Map showing value of wetlands for waterfowl	BSF&W	Waterfowl
c. Sport fisheries (salt water)	9	Extent of fishing water, fishing effort, and value by type in 1955	4	Map depicting value of streams by class	All States	Sport fish
	10	Utilization and value of resource by type of facility	5	Map depicting coastal waters, fishing areas, and major installations by type	BCF	Comm. fish
d. Commercial fisheries (salt water)	11	The 1959 catch			BCF	Sport fish
					BCF	Comm. fish

(Continued)

Steps	Standard tables		Standard maps		Cooperating Agency
	No.	Title	No.	Title	
4. Describe going programs					
a. Wildlife	12	Major fish and/or wildlife areas and installations		"See Item No. 1 above"	BSF&W and States
b. Fresh-water fisheries		"Included in Item No. 12 above"		"Included in Item No. 1 above"	BSF&W and States
c. Salt-water fisheries	13	Installations and major facilities		"Shown in Item No. 5 above"	BCF
5. Evaluate potentials, establish goals, and determine resource requirements. This will require projection of trends, comparison of resource capacity to demand, estimate of gross resource requirements, and deduction of resources available as basis for determining net requirements.	14	Wildlife resources—potentials, goals, and resource requirements			BSF&W and States
	15	Fresh-water fish — potentials, goals, and resource requirements			BSF&W and States
	16	Salt-water sport fisheries — potentials, goals, and resource requirements			BCF
	17	Commercial fisheries — potentials, goals, and resource requirements			BCF
6. Weigh alternatives and propose action					
a. Wildlife	18	Action proposed and estimated costs	6	The Action Plan	BSF&W and States
b. Fresh-water fisheries	19	Action proposed and estimated costs	6	" " "	" "
c. Salt-water fisheries	20	Action proposed and estimated costs	6	" " "	BCF
7. Analyze benefits and costs					
a. Wildlife resources	21	Comparison of use and value in 1955 to projected use and value in 2000 and 1975			BSF&W and States
b. Fresh-water fish	22	Comparison of use and value in 1955 to projected use and value in 2000 and 1975			BSF&W and States
c. Salt-water fish	23&				
	24	Comparison of use and value in 1955 to projected use and value in 2000 and 1975			BCF
8. Schedule action (phasing)					All
9. Summarize findings and draw conclusions					All
10. Compile supporting data and attach as appendices					All

* BSF&W — Bureau of Sport Fisheries and Wildlife; BCF — Bureau of Commercial Fisheries.

Coordination

The Commission staff was responsible for the coordination of all fish and wildlife studies. The studies proceeded concurrently and data were interchanged freely since the completion of a task by one agency was oftentimes dependent upon data supplied by another. To prevent duplication of effort, requests for data between agencies were routed through the office of the Commission.

A Fish and Wildlife Committee was organized for the purpose of assisting the Commission in the preparation of detailed work plans and advising on the results of the studies. It was composed of representatives of the agencies actively participating in fish and wildlife studies and certain consultants who were invited to attend from time to time.

Findings — Wildlife and Sport Fisheries

Measurement of Needs

Use versus demand—Use of fish and wildlife resources for hunting and sport fishing is measured in terms of "man-days" or "user-days," which are synonymous. Either of these terms is defined as any part of a day spent hunting or fishing by an individual. The total user-days expended by the hunters and fishermen residing within a specified area is expressed as the hunting and fishing effort. The impact of this use on a specific resource or area is referred to as the hunting or fishing pressure.

Demand is the total user-days expended by all the people in a specified area if fish and wildlife resources were developed to relatively high levels. It is a difficult to apply this concept, however, since distribution, abundance, availability, and costs of fish and wildlife resources are often the dominant factors influencing utilization. For these and other reasons, total use in 1955 as determined for the Southeast River Basins area is considered to be equal to the 1955 demand except in those instances as noted in the basin appendixes.

The term, "needs," is synonymous to use and demand as construed above.

Current needs—The hunting and fishing effort expended in the Southeast River Basins area in 1955 is estimated to be about 14 million user-

days. This estimate is based largely on an analysis of data collected for the National Survey of Fishing and Hunting which are applicable to the Southeast River Basins area. These data, analyzed by Crossley S-D Surveys, Inc., provide an estimate of the total persons age 12 and over residing in Alabama, Georgia, South Carolina, and northern Florida who hunted and/or fished in 1955 and the average user-days expended per hunter and/or fisherman by type of activity.

From these data, a standard for 1955 was prepared depicting the number of persons age 12 and over per 1,000 population who hunted and/or fished, total user-days of effort expended, and the average number of user-days expended per hunter and/or fishermen.

TABLE 2.53

Hunting and/or Fishing Effort per 1,000 Population of Alabama, Georgia, South Carolina, and Northern Florida, 1955*

	Number of persons age 12 and over	User-days Number	Average per participant
Persons who fished and/or hunted	168	3,510	20.9
Persons who fished	157	2,640	16.8
In fresh water	138	1,943	14.1
In salt water	42	697	16.6
Persons who hunted	62	870	14.2
Big game	5	61	12.5
Small game	59	753	12.8
Waterfowl	6	56	8.9

* Based on special analysis by Crossley S-D Surveys, Inc., New York, New York, of data collected for 1955 National Survey of Hunting and Fishing.

This standard is assumed to also reflect the 1955 per capita hunting and fishing effort by persons residing in the Southeast River Basins area. Estimates as to user-days expended in the eight basins composing the study area are derived by multiplying the 1955 population data of the study area by the standard per capita use data and then adjusting the results in those basins where there is an imbalance between outgoing and incoming use, or where actual use of a specific resource was found to deviate from the standard. In some instances the service area includes large population centers outside the Southeast River Basins area, as in the case of Jacksonville, Florida. This has the effect of in-

creasing the overall needs for hunting and fishing in the study area.

Future needs—By 2000, an estimated 42 million user-days of hunting and fishing will be expended in the study area if the resources are developed commensurate with the needs. This estimate is derived by first multiplying the projected population of the Southeast River Basins area times the projected per capita demand for fishing and/or hunting and then making certain adjustments for reasons described in the previous paragraph. Estimates for hunting, fresh-water fishing, and salt-water fishing are determined in a similar manner utilizing standard per capita demand data, Table 2.54.

These per capita demand projections are based on special studies conducted by the cooperating Federal and State agencies. Population trends are related to the sale of resident licenses, duck stamps, and special use permits.

Basic data with respect to population growth, population characteristics of Southeast River Basins and adjacent areas, per capita income, and leisure time were made available to the cooperating agencies for reference purposes.

The total population increase and trend toward urbanization are considered to be decisive factors influencing total hunting and fishing demand. The per capita demand for hunting and fishing decreases as urbanization increases. This was readily apparent in comparative studies of hunting and fishing license sales in urbanized and rural counties. The analysis of recent trends of hunting and fishing license sales per 1,000 inhabitants in Florida where urbanization is far

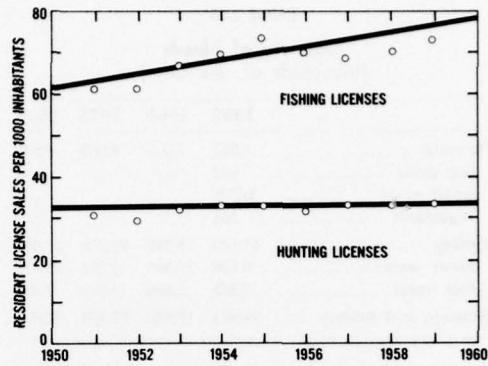


Figure 2.4 A Comparison of License Sales Trends in Florida, 1950-59.

advanced also revealed a lower rate of increase than in the less urbanized States of the study area, Figure 2.4.

A further decrease in the percent of rural population is expected, while the urban population is expected to continue to expand rapidly. The net effect will result in a significant increase in hunting and fishing demand in spite of an expected decline in per capita demand after 1975.

Use of publicly owned and managed areas will continue to increase at a rate greater than the general increase in population and overall hunting and fishing effort. This, too, reflects the impact of urbanization. Closure of more private lands to public use will make it increasingly difficult for the urbanite to find a place to hunt, despite increases in travel, leisure time, and per-

TABLE 2.54
Per Capita Demand for Hunting and Fishing Opportunity

Activity	Actual 1955 user-days per person	Projected		
		1975 User-days per person	Percent increase over 1955	2000 User-days per person
Sport fishing	2.640	3.168	20	3.051
Fresh water	1.943	2.332	20	2.215
Salt water	0.697	0.836	20	0.836
Hunting	0.870	0.957	10	0.861
Big game	0.061	---	---	---
Small game	0.753	---	---	---
Waterfowl	0.056	---	---	---
Fishing and hunting	3.510	4.125	17.5	3.912

TABLE 2.55
Summary of Needs
(thousands of user-days)

	1955	1960	1975	2000
Hunting	3,962	4,663	6,663	8,989
Big game	582	—	—	—
Small game	3,212	—	—	—
Waterfowl	168	—	—	—
Fishing	11,109	13,269	21,272	33,081
Fresh water	8,806	10,583	17,294	25,413
Salt water	2,303	2,686	3,972	7,668
Hunting and fishing	14,071	17,932	27,935	42,070

sonal income. The spectacular increase in hunting pressure on two of the wildlife management areas in Florida exemplifies this trend.

No attempt was made to project the hunting and fresh-water fishing demand by type, since it was evident that future use of a resource would be determined largely by supply, availability, and costs as will be discussed later in this Report.

The estimates for 1960 are based on an interpolation of historic data available through 1955.

Measurement of Supply

General—Fish and wildlife resources are treated in three broad categories: (1) Habitat, (2) fish and wildlife populations, and (3) programs and facilities for the preservation and development of fish and wildlife resources.

Ground cover map and other data—As an initial step in the inventory of wildlife and fish resources, the Bureau of Sport Fisheries and Wildlife prepared a cover map of the Southeast River Basins area, scale 1:500,000, showing forested, cleared, interspersed, urban areas, marshlands, and water bodies. The cover map was designed to provide quantitative information concerning the type, distribution, and pattern of cover by State, basin, and physiographic province. It also provided a basis for determining the acreage of big game and small game habitat and in estimating existing and potential wildlife populations. The map, coupled with the wildlife inventory, has proven to be extremely valuable in visualizing the present distribution of wildlife in relation to cover, plotting the location and extent of wildlife habitat and wildlife developments, and determining prospective locations for new developments.

The acreage of coastal marshes was computed using 1955 wetland classification and evaluation data compiled by the Bureau of Sport Fisheries.

In instances where impoundments had been constructed since 1960, the basic date of land area totals used by the U. S. Study Commission, the acreage of new waters was subtracted from the acreage of land and appropriate notations made in the summary tables.

Water bodies are subdivided into large impoundments 40 acres or more in size and major streams $\frac{1}{8}$ mile or more in width. Mileage of major streams consists only of those portions of the streams in excess of $\frac{1}{8}$ mile in width. The water surface acreages were determined from quadrangle maps correlated with data and tables, *Land and Water Areas by Counties—1940*, contained in a publication of the U. S. Department of Commerce, Bureau of Census, entitled, *Area of United States—1940*. Updating of these computations was accomplished through the use of the base quadrangle maps and other data.

The number and acreage of farm ponds are based on a special study conducted by the Soil Conservation Service.

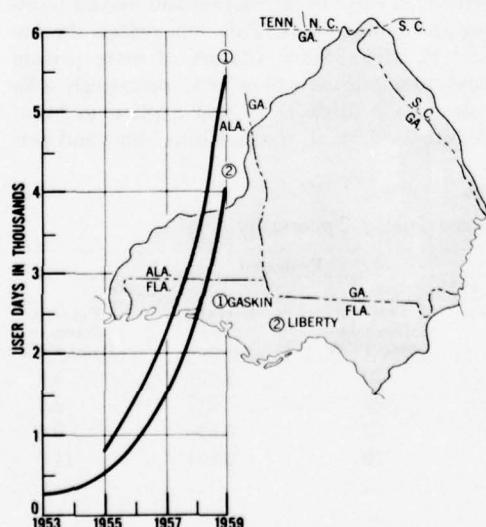


Figure 2.5 Increase in Hunting Pressure on Two Typical Wildlife Management Areas.

FISH AND WILDLIFE

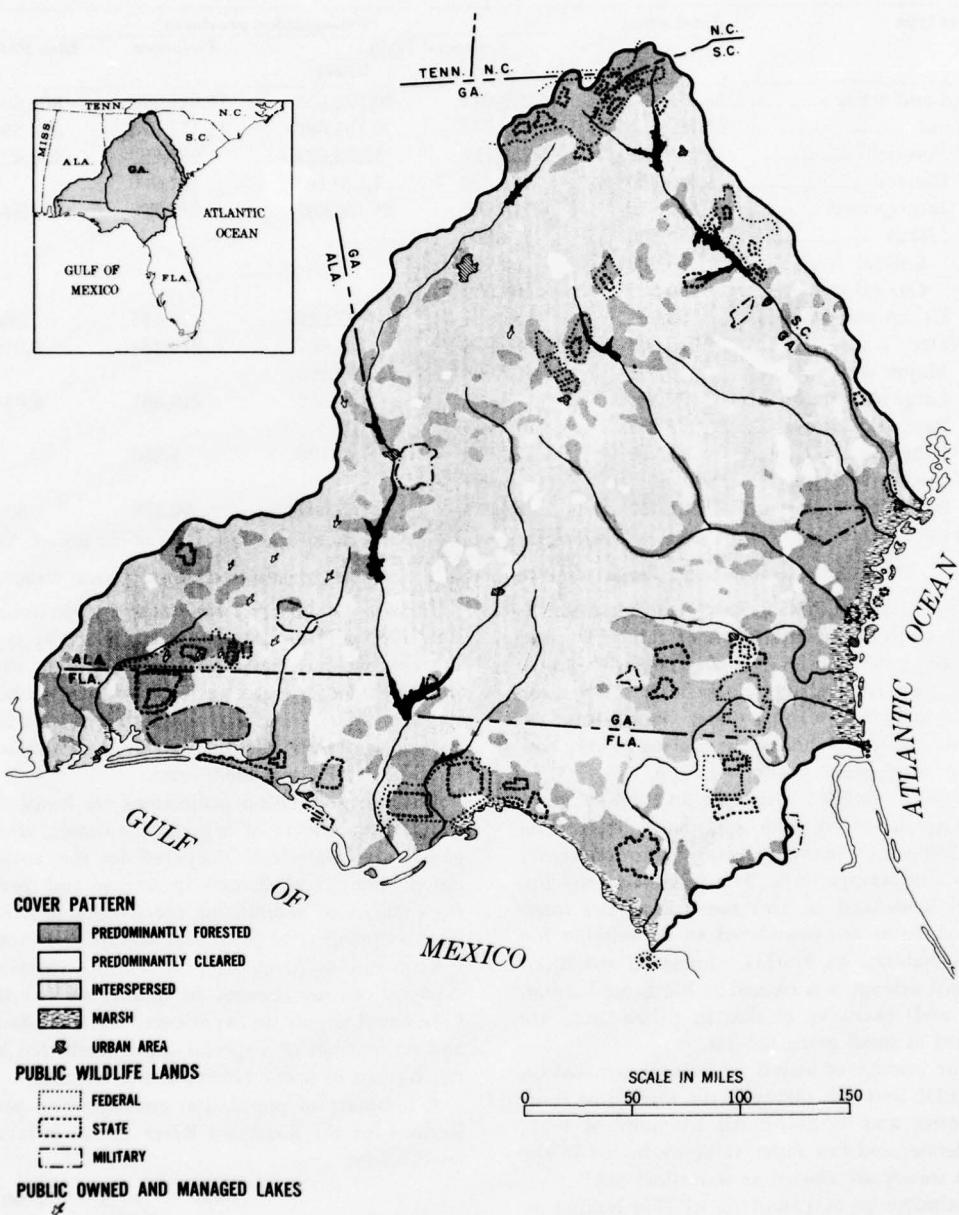


Figure 2.6

TABLE 2.56
Inventory of Fish and Wildlife Habitat Southeast River Basins Area¹
(acres)

Cover type	Total area	Physiographic provinces			Blue Ridge
		Coastal Plain	Upper	Piedmont	
Lower					
Land and water	56,135,937	13,287,944	30,392,653	11,645,740	809,600
Land	55,120,631	12,692,008	30,193,686	11,431,376	803,561
Forested	15,009,861	6,955,159	5,334,624	1,988,257	731,821
Cleared	2,139,330	434,202	1,520,168	184,960	
Interspersed	37,062,536	4,736,603	23,166,667	9,087,726	71,540
Marsh	514,950	514,950			
Coastal fresh	50,400	50,400			
Coastal saline	464,500	464,550			
Urban and other	393,954	51,094	172,227	170,433	200
Water	1,015,306	595,936	198,967	214,364	6,039
Major streams ²	156,197	137,008	19,189		
Large impoundments	432,376	56,601	156,652	213,084	6,039
Bays and sounds	379,155	379,155			
Other	47,578	23,172	23,126	1,280	
Nonadditive items					
Small impoundments	121,382	22,839	68,007	30,138	398

NOTES: ¹ Total habitat acreages differ by less than $\frac{1}{2}$ percent from acreages used in other parts of the Report. This variation was regarded as insignificant for fish and wildlife planning.

² Includes 826 miles of major streams in the Lower Coastal Plain and 209 miles in the Upper Coastal Plain.

Kinds of wildlife—Primary consideration is given to those wildlife forms of value for hunting. Big game species evaluated are white-tailed deer, wild turkey, and black bear; small game forms include mourning doves, bobwhite quail, rabbits, squirrels, and rails; and waterfowl consist of wild geese, ducks and coots.

Wildlife habitat estimates and projections—The acreage of big game and small game habitat in 1960 was estimated utilizing the ground cover map and acreage data. The predominantly forested lands and at least one-half of the interspersed lands are considered to be suitable big game habitat. In Florida, almost all the interspersed acreage was treated as big game habitat. All lands exclusive of that in urban areas are classed as small game habitat.

The acreage of waterfowl habitat is based on the 1955 wetlands survey of the Bureau of Sport Fisheries and Wildlife. All wetlands of high, moderate, and low water value evaluated in the 1955 survey are classed as waterfowl habitat.

Estimates as to extent of wildlife habitat in 1975 and 2000 are based largely on projected changes in major land uses. These changes are described in Appendix 9, Economics.

Wildlife population estimates and projections—The 1960 wildlife population estimates, by type of resource, are based on inventory data supplied by the cooperating agencies, adjusted when inventory data were unavailable by multiplying the acreage of occupied habitat by the estimated wildlife density per 1,000 acres.

Wildlife population projections are based on trends in numbers of big game animals, small game, and waterfowl tempered by the anticipated influence of changes in acreage and carrying capacity of habitat, the effectiveness of existing and prospective programs, and other factors.

Estimates as to changes in wildlife carrying capacity due to changes in quality of habitat were based largely on experience, available data, and on findings of a special study conducted by the Bureau of Sport Fisheries and Wildlife.

A summary of population estimates and projections for the Southeast River Basins is tabulated below:

Type	1960	1975	2000
			(number)
Big game animals	223,000	460,000	520,000
Small game animals	31,326,000	31,234,000	30,766,000
Waterfowl	277,000	277,000	277,000

Kinds of sport fishes—Sport fishes are defined as those fishes normally caught by anglers for recreational purposes. More specifically the fresh-water sport fishes evaluated are those listed by Surber, 1959, in his standard methods of reporting fish population data for reservoirs, plus the fresh-water catfish. The salt-water sport fishes are those listed for the Gulf and South Atlantic regions in The 1960 Salt Water Angling Survey, Circular 153, Bureau of Sport Fisheries and Wildlife.

Fish habitat—All streams of particular value for fishing are identified, evaluated with respect to carrying capacity of desirable forms of fish, and measured as to length and total surface acres.

Large impoundments are defined as all inland lakes, reservoirs, and other impoundments, except farm ponds, with a surface area of 40 acres or more. Acreage data are the same as that compiled for the wildlife inventory.

Small impoundments are defined as all lakes and reservoirs of less than 40 acres including all farm ponds inventoried by the Soil Conservation Service, 1960. In the wildlife inventory the combined acreage of small impoundments is included in the total land acreage. For fisheries planning, however, the acreage of small natural lakes and reservoirs is estimated and added to the total number and acreage of farm ponds as inventoried by the Soil Conservation Service.

Salt-water fish habitat is comprised of all water lying between the mainland and the barrier islands plus the open water of the sea for a distance of 12 to 20 miles offshore, the recognized limit of most sport fishing activity. Acreage of these waters was determined by first delineating, then planimetering, the habitat on coastal geodetic survey charts.

The acreage of fish habitat by type in 1960 and projections for the Southeast River Basins area are summarized in the following tabulation:

Habitat type	1960	1975	2000
	(thousands of acres)		
Streams	119	114	114
Large impoundments	270	430	430
Small impoundments	152	233	336
Salt water	5,308	5,308	5,308

Estimates as to the extent of fish habitat in 1975 and 2000 are based largely on prospective construction of large and small impoundments,

loss of streams which would result from these impoundments, and changes effected by land use and other water developments.

Fish populations—The species composition of the fish population inhabiting representative types of water is based on sample data made available by the cooperating State game and fish departments. The total number and weight of fish in the waters under consideration were not determined although information was obtained on which to estimate the relative productivity of the various types of habitat in each of the physiographic provinces.

Extent of development—An inventory of public waters, public lands, and facilities and a description of programs being carried out by public and private interests reflect extent of fish and wildlife development. Significant trends in growth of programs in relation to public demand for services and use of facilities evidence their role in meeting the needs for fishing opportunity.

Formulation of Action Program

Wildlife potentials—Appraisal of the adequacy of wildlife resources to meet the needs for hunting opportunity requires a ready means of comparing the user-days capacity of existing and prospective supplies with the user-days demand.

Hunting capacity is defined as the number of user-days hunting per year which a given resource will satisfy and sustain at a specified level of management. The appraisal of hunting capacity of a given area is based on: (1) Acres of habitat; (2) wildlife population density expressed in terms of animals per acre; (3) population harvest ratio; and (4) hunter success.

The harvest potential denotes the sustained number of animals which could be annually harvested from a given population by hunting. The ratio of total population to annual harvest employed in establishing standards are: Big game, 4 to 1; small game, 3 to 1; and waterfowl, 3 to 1.

Hunter success implies the number of hunter-days which could be provided by each unit of game harvested. One deer bagged was considered sufficient reward to the hunter for 20 hunter-days; two units of small game for 1 hunter-day; and 1 waterfowl for 1 hunter-day.

Using these criteria, the following formula was employed in the studies in estimating the hunter-

days capacity per 1,000 acres of habitat.

$$\frac{\text{Wildlife density}}{\text{Harvest ratio}} \times \frac{\text{Hunter-days}}{\text{per animal harvested}} = \text{Capacity}$$

For example, let 20 equal big game animals per 1,000 acres, 4 equal the ratio of total population to harvest, and 20 equal hunter-days per animal harvested. Then $20/4 \times 20 = 100$ user-days capacity per 1,000 acres or 0.10 user-days per acre.

Graphs depicting the relationship between density, harvest ratio, and hunter success were prepared as a ready means of rating the user-days capacity of a specific area.

Estimates as to hunter-days capacity of the habitat in the Southeast River Basins in 1960, 1975, and 2000, based on existing and prospective numbers of game animals with normal expansion of going programs are shown in Table 2.59.

The potential user-days capacity of wildlife resources in the study area is also estimated as a guide to the level of use which might be realized if all the habitat were managed at a high level.

Standard criteria generally employed in evaluating the potential user-days capacity of habitat in the Southeast River Basins are as follows:

	Resource		
	Big game	Small game	Water-fowl
Acres of habitat	1,000	1,000	1,000
Wildlife			
Acres per animal	50	1.67	4
Population	20	600	250
Harvest			
Ratio	4:1	3:1	3:1
Number	5	200	83
User-days			
Per animal harvested	20	0.5	1
Total capacity	100	100	83

The potential user-days capacity per year of all habitat in the study area, using these criteria, is summarized in the following tabulation:

Type	1960 (thousands of user-days)	1975	2000
Big game	3,686	3,835	3,854
Small game	5,427	5,379	5,176
Waterfowl	280	280	280

Sport fishing potentials — Appraisal of the adequacy of sport fisheries to meet needs for fishing opportunity also requires a ready means of comparing use by anglers to angler-days capacity.

Angler-days capacity — Total user-days of sport fishing per year which a given body of water will satisfy and sustain at a specified level of management.

The appraisal of the angler-days capacity of most waters in the basin was based primarily on: (1) The standing crop of sport fishes, (2) the crop of harvestable-sized sport fishes, (3) catch potential, and (4) angler success.

The standing crop as measured in pounds of fish per acre is used as an index of the productivity of a given body of water, although there is no exact correspondence between standing crop and the total amount of fish produced.

The total percentage by weight of the fish population composed of sport fishes of harvestable size, designated as the A_t^h value¹, is used as an index to the harvestable crop.

Of the harvestable crops of sport fish in small streams, small impoundments, and certain large reservoirs of less than 1,000 acres, such as the State-owned and managed lakes in Alabama, it is assumed that one-half may be removed annually by sport fishermen. In most other waters, the catch potential is considered to be one-third of the harvestable crop of sport fishes.

An average catch of 2 pounds per angler-day is used as a measure of a successful fishing trip.

Utilizing these criteria, the following formula is used in estimating the angler-days capacity of specific bodies of water:

$$\frac{\text{Standing crop} \times A_t^h \text{ value}}{\text{Harvest ratio}} \div \frac{\text{Average catch}}{\text{in pounds per angler-day}} = \text{Capacity}$$

For example, let 400 pounds equal the standing crop, 75 percent equal A_t^h value, 3 equal the ratio of the harvestable crop to the potential catch, and 2 equal the average catch in pounds per angler-day.

Then, $\frac{400 \times 75\%}{3} \div 2 = 50$ (angler-days capacity per year)

¹ At = Total availability value. Percentage of total weight of a fish population composed of fish of harvestable size.

A_t^h = That portion of the At value composed of species that are normally harvestable.

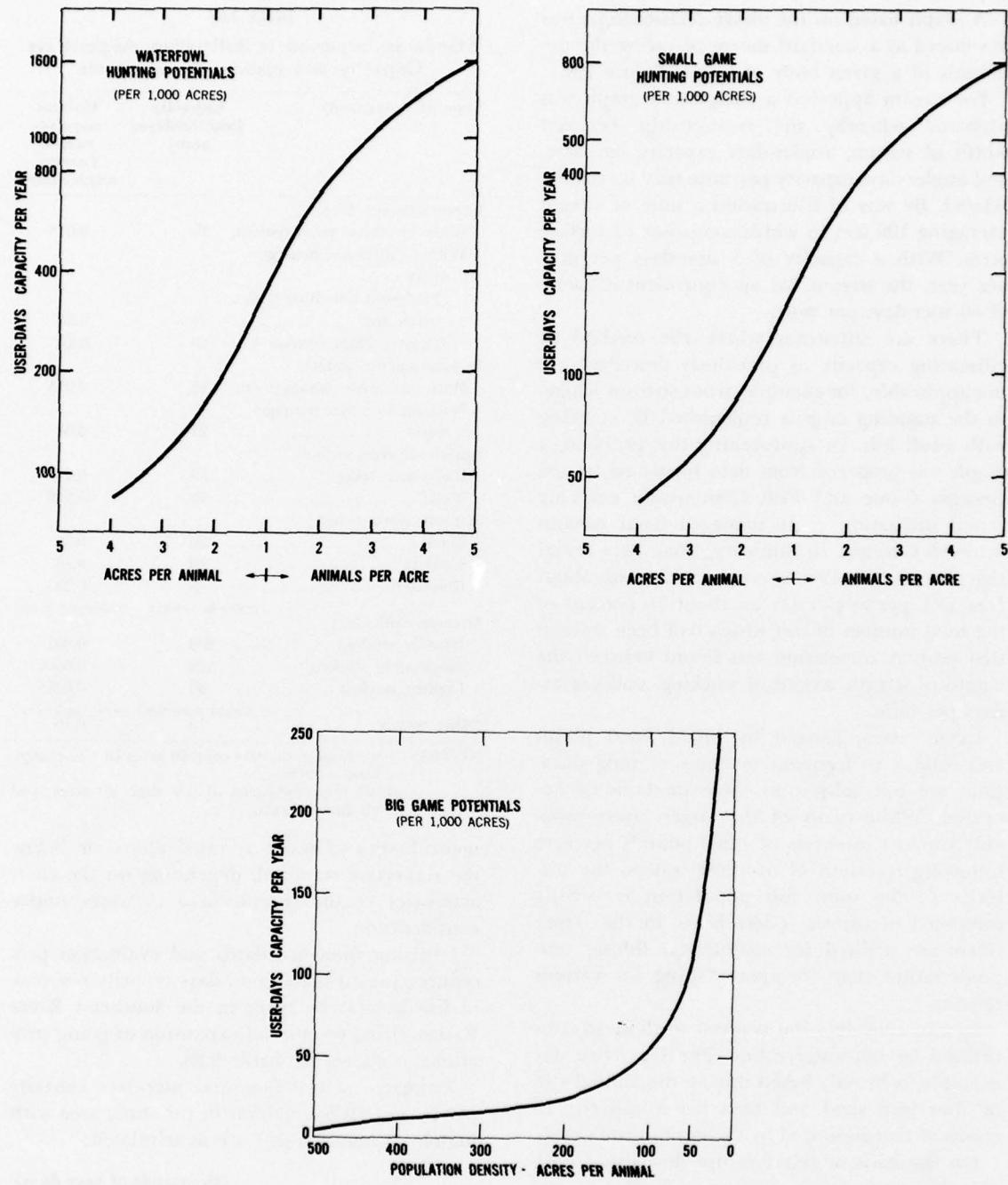


Figure 2.7 *Game Potentials.*

A graph based on the above relationships was developed as a standard means of rating the potentials of a given body of water, Figure 2.8.

For stream appraisal a companion graph was prepared whereby the relationship between width of stream, angler-days capacity per acre, and angler-days capacity per mile may be readily related. By way of illustration a mile of stream averaging 100 feet in width comprises 12 surface acres. With a capacity of 5 user-days per acre per year, the stream has an equivalent capacity of 60 user-days per mile.

There are situations where the method of estimating capacity as previously described are not applicable; for example, trout streams wherein the standing crop is replenished by stocking with adult fish. In approaching this problem, a graph was prepared from data furnished by the Georgia Game and Fish Commission covering actual utilization of 16 managed trout streams in north Georgia. In summary, these data reveal that the catch in 1960 averaged 2.77 trout, about 1 pound, per angler-day or about 76 percent of the total number of fish which had been stocked that year. A correlation was found between the length of stream, extent of stocking, and angler-days per mile.

Large rivers, flanked by broad flood plains and subject to frequent overflow of long duration, are not subject to these methods of appraisal. While many of the larger rivers probably support in excess of 1,000 pounds per acre following recession of overflow waters, the majority of the sport fish population is usually composed of catfish. These fishes in the larger rivers are utilized for commercial fishing purposes rather than for sport fishing for various reasons.

Special consideration is given to those streams utilized by salt-water fishes. The Ogeechee, for example, is heavily fished during the annual run of American shad and thus has a capacity in excess of that indicated by the nonmigratory crop.

On the basis of relationships described, available data concerning standing crops, and special situations as noted, standards are established which serve as a general guide to rating the angler-days capacity of typical waters within the Southeast River Basins; also as a means of converting user-day needs into acres of habitat required. Actually, the angler-days capacity of

TABLE 2.57
Standards Employed in Estimating Angler-Days Capacity and Habitat Requirements

Type of water body	Capacity (angler-days/ acre)	Habitat require- ments (acres/ angler-day)
Impoundments, large ¹		
With intensive management	75	0.013
Without intensive management		
(Piedmont and Blue Ridge provinces)	5	0.20
(Coastal Plain province)	10	0.10
Impoundments, small ²		
With intensive management	75	0.013
Without intensive management	25	0.04
Impoundments, special		
Backwater lakes	50	0.02
Tidal	75	0.013
Streams, warm water		
Class I	20	0.05
Class II	10	0.10
Class III	5	0.20
	(angler-days/mile)	(miles/angler-day)
Streams, cold water		
Heavily stocked	500	0.002
Moderately stocked	150	0.0066
Lightly stocked	35	0.0285
	(angler-days/acre)	(acres/angler-day)
Other waters	10	0.10

NOTES: ¹ All impoundments over 40 acres in size except farm ponds.

² All impoundments of less than 40 acres, and all farm ponds.

many bodies of water is rated above or below the respective standard, depending on the characteristics of the specific area or areas under consideration.

Utilizing these standards and evaluation procedures, the estimated user-days capacity per year of fish habitat by types in the Southeast River Basins, based on normal expansion of going programs, is shown in Table 2.58.

Estimates of the potential user-days capacity per year of all fish habitat in the study area with high-level management are as tabulated:

Type of habitat	(thousands of user-days)		
	1960	1975	2000
Cold water streams	247	247	247
Warm water streams	2,480	2,280	2,280
Large impoundments	2,700	4,300	4,300
Small impoundments	11,175	17,250	24,975
Salt water	26,540	26,540	26,540

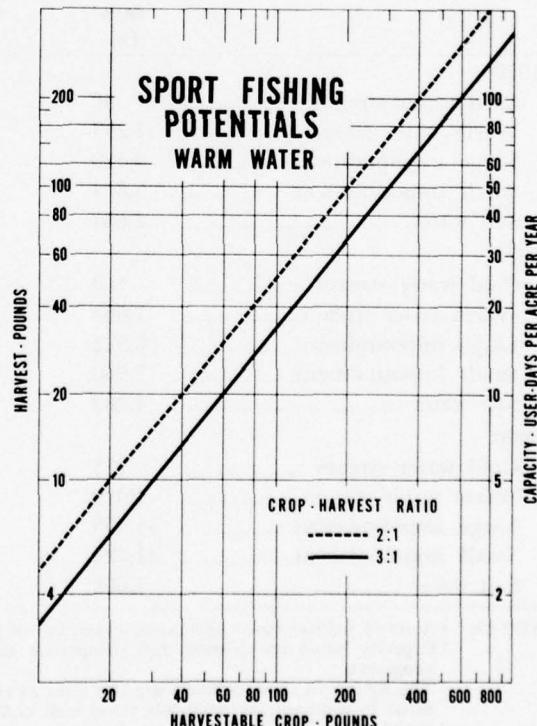
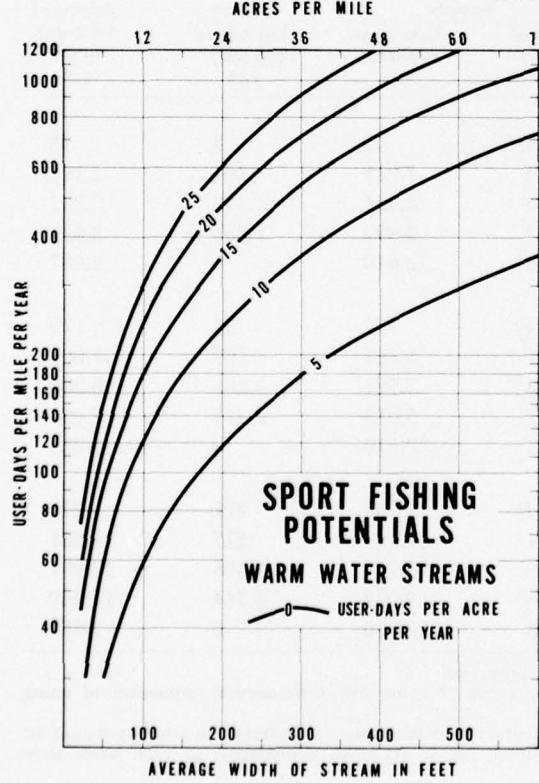
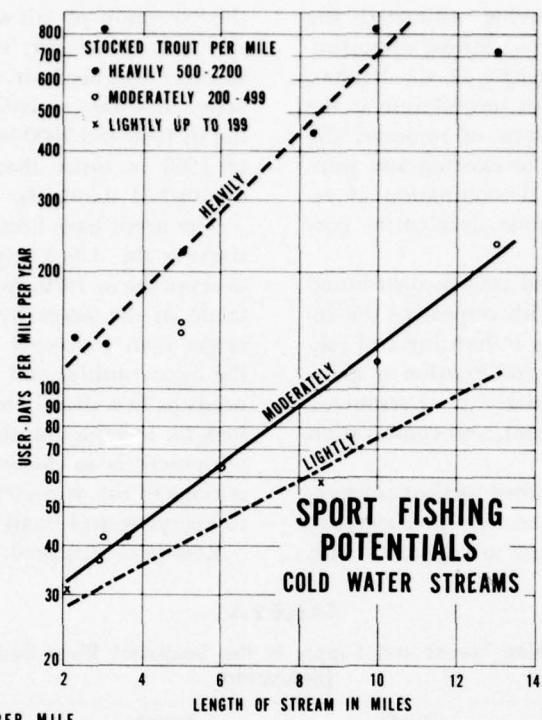


Figure 2.8 Sport Fishing Potentials.

Needs and supply — Having estimated the overall needs for hunting and fishing opportunities and the potential capacity of the habitat, the next major step in plan formulation is the distribution of needs by type of resource, the comparison of these needs to existing and prospective supplies, and the determination of resources required to overcome deficiencies now and in 1975 and 2000.

Projected use in 1975 and 2000 is distributed to each type of resource with respect to the influence of long-range trends in hunting and fishing effort, preferences, type and location of sport, prospective inventories, availability of resources, opportunities for development, and conservation objectives.

When the needs are weighed against prospective supplies, deficits in the user-days capacity of every type of basic resource are apparent with

the exception of salt-water habitat, Tables 2.58 and 2.59. Moreover, the analysis discloses that to meet the needs it will be necessary to take action not only to satisfy the difference between use in 1960 and 2000 but also the deficit capacity in 1960 in order that all user-days will meet established standards.

The needs have been adjusted to 1960 by subtracting the deficit capacity from the user-days as reported in 1960. Adjustments also have been made in the needs by type of resource in the target years following more detailed analysis of the opportunities and feasibility of meeting the needs as first distributed. For example, the outlook for meeting hunting needs by waterfowl development is so discouraging that a larger percentage of the projected use is finally distributed to big game and small game hunting.

Resources required to meet the needs for

TABLE 2.58
Sport Fishing Needs and Supply in the Southeast River Basins Area
(thousands)

Year and type of activity	Needs	Supply	Deficit	Adjusted user-day needs
	User-days (a)	Acres of habitat ¹ (b)	User-days capacity ² (c)	User-days capacity ³ (d)
1960				
Cold water stream	56	4 (664)	53	3
Warm water stream	1,293	119	1,911	101
Large impoundment	3,420	270	2,451	1,178
Small impoundment	5,814	152	3,979	2,383
Salt water	2,687	5,308	22,610	0
1975				
Cold water stream	110	4 (664)	53	57
Warm water stream	1,608	114	1,821	107
Large impoundment	6,922	430	3,721	3,201
Small impoundment	7,560	222	5,933	2,313
Salt water	4,289	5,308	22,610	0
2000				
Cold water stream	275	4 (664)	53	222
Warm water stream	1,979	114	1,821	217
Large impoundment	11,399	430	3,721	7,678
Small impoundment	11,780	336	9,022	3,744
Salt water	7,668	5,308	22,610	0

NOTES: ¹ Acres of habitat based on normal expansion of going programs.

² Capacity based on existing and prospective standing crops of game fish with normal expansion of going programs.

³ The figures in these columns are the sums of equivalent data in the basin appendixes. No attempt should be made to compare arithmetically these with either column (a) or (c) since adjustments in each basin were individually determined.

⁴ Cold water streams measured in miles.

TABLE 2.59
Wildlife Needs and Supply in the Southeast River Basins Area
 (thousands)

Year	Type of activity	Needs	Supply	Deficit	Adjusted
		User-days (a)	Acres of habitat (b)	User-days capacity (c)	user-day needs (e)
1960					
	Big game hunting	877	36,686	1,115	742
	Small game hunting	3,609	54,276	5,219	3,524
	Waterfowl hunting	177	3,382	94	93
1975					
	Big game hunting	1,639	38,351	2,300	1,643
	Small game hunting	4,817	53,794	5,187	4,824
	Waterfowl hunting	207	3,382	94	186
2000					
	Big game hunting	2,647	38,547	2,540	2,394
	Small game hunting	6,088	51,768	5,026	6,395
	Waterfowl hunting	254	3,382	94	191

NOTES: ¹ Based on existing and prospective inventory of game with normal expansion of going programs.

² The figures in this column (d) are the sum of equivalent data in the basin appendices. While they were derived in the basin reports by subtracting user-days in column (c), from user-days in column (a), it does not follow that this is true in the Southeast River Basins due to variation in geographic distribution of needs and supplies.

hunting opportunity were determined by computing the difference between adjusted use in 1960 and that in 1975 and 2000. The increases in user-days of hunting and fishing over 1960 are then converted into numbers of animals required to satisfy this increased effort.

The acreage of habitat required to support the required number of animals is determined on the basis of the quality of habitat and level of management planned. For example, the need for an additional 1,000 user-days of big game hunting could be met by a big game population of 200 animals on 5,000 acres of habitat managed at a high level or 200 animals on 10,000 acres of the same quality habitat managed at a medium level. Similarly, 1,000 user-days of sport fishing per year could be sustained by about 14 acres of impoundments managed at a high level or 100 acres managed at a low level.

Action proposed — Possible solutions to key problems and alternate means of achieving the desired levels of production and use are explored. Projects and programs which appear to afford the most feasible solution are analyzed in greater detail and when economically feasible included in the functional plan.

Design criteria — Design criteria for most projects considered are based on comparable type situations. For example, small impoundments for waterfowl purposes are based on typical installations in the Upper Coastal Plain, Georgia; Nassau Embayment project is patterned after the Guano River project, Florida. Specifications for fishing lakes are based on State-owned and managed fishing lakes in Alabama. In the development of some projects for which there are little design data available, it was necessary to formulate guidelines based on site examination and applied experience. Special studies with respect to stream improvement led to the preparation of a published paper entitled, *Low-Flow Regulation as a Means of Improving Streams for Fishing*, Wood and Whelan, 1962.

Benefits and costs — Benefits to fish and wildlife development for recreational purposes are evaluated by applying a range of derived values to the projected increase in user days over 1960.

The schedule of values recommended by the Inter-Agency Committee on Water Resources, Subcommittee on Evaluation Standards, 1960, are employed in most instances.

The future situation "without" and "with"

TABLE 2.60
A Comparison of Standard Values Per User-Day of Fishing and Hunting (dollars)

Item	Standard range of values ¹	Values employed in studies ²
Fishing		
Reservoir	0.50 to 1.50	1.50
Stream or lake		
Warm water	0.50 to 1.50	1.50
Cold water and bass fishing	1.00 to 3.00	3.00
Salt water		3.00
Hunting		
Small game		2.00
Mammals	0.50 to 1.50	
Birds	1.00 to 3.00	
Waterfowl	1.50 to 4.50	4.00
Big game		
Deer and antelope	1.50 to 4.50	5.00
Other	2.00 to 6.00	

NOTES: ¹ Recommended for interim use by the Inter-Agency Committee on Water Resources, Subcommittee on Evaluation Standards, Panel on Recreational Values for Recreational Aspects of Fish and Wildlife.

² If facilities are developed to U. S. Study Commission standards.

the project in existence was analyzed as the basis for determining the extent to which the benefits would contribute toward realization of established goals. The "without" project situation for an individual project analysis includes all development which could realistically exist in the complete absence of the project and all of its dependent parts. Technological and other developments which could proceed independent of the project are included in "without" project conditions. Under "without" project conditions it is assumed that any portion of the project would not be developed under going programs or through individual efforts even though this might be expected on the basis of existing trends.

The "with" project situation for individual project analysis includes all development which could realistically exist with the project in existence over the period of analysis.

The costs of action proposed consist of those expenditures over and above the costs incurred in 1960. They cover costs of initial investment and the annual expenditures required for operation, maintenance, and replacements. For evaluation of the merits of a program or project, the investment and annual operation, maintenance,

and replacements costs are expressed as annual equivalent costs based on a 50-year period of analysis.

Benefits and costs estimates, like project design, are largely based on results achieved by projects in comparable situations. Excellent data are available with respect to costs of some developments and use of the State-owned lakes, national forests, wildlife management areas, and trout streams. A special analysis was made of total expenditures of the Florida Game and Fresh Water Fish Commission in 1958 by type of activity as a guide to estimating future costs of some supporting programs. These and other data were employed in developing standard benefit-cost data for various types of projects as are described in Appendix 11, Engineering and Cost.

Findings — Commercial Fisheries

Measurement of Needs

Estimates of current needs for commercial fish from Southeast River Basins waters are based on the assumption that demand in 1960 is equivalent to the average annual catch landed at ports in the Southeast River Basins from 1955-59.

Estimates as to future needs are based on the assumption that the Southeast River Basins catch in 1975 and 2000 should be increased directly proportionate to the projected population of the United States. The basis for this assumption is as follows:

(1) Fish landed at ports in the Southeast River Basins are marketed throughout the United States.

(2) The national per capita consumption of fishery products has been relatively stable for a considerable length of time and is expected to remain stable in the future.

(3) Production in the Southeast River Basins could contribute to future national demand in the same proportion as in 1960 if resource potentials are developed commensurate with projected needs.

In taking this position, the Commission recognizes that the commercial fishing industry generally has not kept pace with the economic growth of the region. Domestic production of food fish in the Southeast River Basins and in the Nation declined during 1950-60 despite an

TABLE 2.61
An Analysis of U. S. Population Projections and Catch Requirements in the United States and in the Study Area

	For food			For other than food		
	1960	1975	2000	1960	1975	2000
United States						
Population (millions of people)	180	235	380	180	235	380
Total catch (million lbs. of fish)	2,542	3,313	5,358	2,394	3,125	5,054
Catch per capita (lbs. of fish)	14.1	14.1	14.1	13.3	13.3	13.3
Southeast River Basins						
Total catch (million lbs. of fish)	48.9	63.8	103.2	42.6	55.6	90.0
Catch in SERB per capita in United States (lbs. of fish)	0.272	0.272	0.272	0.235	0.235	0.235

increased fishing effort. Unwise use, fluctuations in supply, increased production costs, competition from other animal protein foods and from high quality fishery products from abroad, and insufficient knowledge of the sea and its resources have been mainly responsible. Fish imports, on the other hand, have steadily increased. Notwithstanding, it is assumed that, in view of the potentials for development in the Southeast River Basins and the prospects for management and technological improvements as revealed by allied studies, the commercial fishing industry can meet foreign competition in the future.

Standards of living in the competing foreign countries are much below that of the United States and it may be assumed that some of their competitive advantages will lessen or disappear as their standards of living increase in the future.

In the application of these concepts the average annual catch of fish as reported for the Nation and the Southeast River Basins area during the period 1955-59 is converted into the pounds of fish landed per person in the United States.

Future needs for the Southeast River Basins area are computed by simply multiplying the per capita catch in 1960 by the projected population of the United States in 1975 and 2000. This reflects an increase in total catch requirements over 1960 of about 1.3 times by 1975 and 2.1 times by 2000. Overall production goals for each basin are determined by multiplying this factor times the annual catch from 1955-59.

Catch requirements by species in 1975 and 2000 are established by distributing the catch on a judgment basis following consideration of many factors including consumer preference, availability of supplies, and opportunities for development.

TABLE 2.62
Annual Commercial Catch Requirements
 (thousands of pounds)

Catch	1960*	1975	2000
For food			
Selected finfish	12,647	13,948	18,580
Shrimp	11,947	12,594	13,927
Crabs	17,815	22,197	33,759
Oysters	1,514	1,882	2,841
Miscellaneous finfish and shellfish	5,016	5,981	7,980
Other fishes		7,208	26,113
Subtotal	48,939	63,810	103,200
For other than food	41,440	55,650	89,980
Total	90,379	119,460	193,180

* Based on average annual catch 1955-59.

Measurement of Supply

Commercial fishery resources treated in the basin studies include the habitat, fish populations, commercial fishermen, and facilities.

Practically all types of water bodies in the Southeast River Basins area are potentially valuable for commercial fish production. Commercial fishery studies, however, are limited for the

most part to an analysis of the resources associated with coastal saline water since 95 percent or more of the catch is obtained from this source.

Two general categories of salt water are recognized: (1) Inshore or estuarine waters which include all of the salt and brackish water bays, sounds, rivers, creeks, and marshes; and (2) the offshore waters which include the shelf environment extending from the outer beaches to about the 100-fathom line and the oceanic environment extending seaward from the shelf.

The extent of inshore waters is measured in miles of coast, also in acres of water lying between a line extending along the outer beaches and the mainland. The acres of offshore waters for a distance of 12 miles to 20 miles seaward from the outer beaches also are tabulated as one means of comparing the extent and type of fishing waters readily accessible to most fishermen along the Southeast River Basins coast.

Commercial catch statistics are employed as a means of indicating distribution and relative abundance of the more important commercial fishes as well as the extent of utilization.

Landings and values of the commercial catch were obtained from the data collected periodically by statistical agents of the Bureau of Commercial Fisheries. These data, by county, are published annually for Florida in *Florida Commercial Landings*. Landings and values by county for Georgia, South Carolina, and Alabama, however, are published every 5 years in *Statistical Digests*. As original data were collected by county, the Bureau of Commercial Fisheries requested and was furnished these data by the statistical agents involved for use in the technical memoranda.

In many instances, the coastal area of a county is shared by two river basins; for example, Chatham County, Georgia, contains coastal areas of the Savannah and Ogeechee basins. Following discussions on the subject with the statistical agents of the area in question, the commercial landings were prorated for each basin of such counties with what was believed to be reasonable accuracy. The same principle is followed for counties lying partly within and partly outside Southeast River Basins; for example, Duval County, Florida. The assigned basin percentages of the landings of these counties are tabulated

as supplemental data in each basin technical memorandum and are explained in the text.

The commercial fishing effort is indexed by statistics covering the type and number of fishing craft and the number of fishermen by whole counties.

The extent of development is substantiated by an inventory of shore establishments which include all business houses, factories, and plants engaged in receiving, processing, and distributing of fish caught for commercial purposes.

Formulation of Action Program

Appraisal of the adequacy of existing and potential commercial fishery resources to meet the overall projected demand requires an evaluation of the prospects for increasing the catch of selected fishes.

Areas of potential production of selected species are reflected largely by an analysis of catch trends, fishing effort, market, and facilities. The acreage of existing and depleted oyster reefs is compared with the acreage of reefs surveyed in early days.

Problems and opportunities attendant to the production, harvesting, handling, processing, and distribution of commercial fishes are identified and evaluated. Goals in terms of pounds of fish to be harvested by species or groups are established by distributing the total catch requirements on the basis of prospective increases in production and demand.

Possible solutions to key problems and alternate means of achieving the desired levels of production were explored. Projects and programs appearing to afford the most feasible solution were analyzed in greater detail and, if economically feasible, are included in the functional plan.

Benefits to commercial fishing are measured as value of increased production at expected dockside market prices. Benefits are a direct evaluation of each project contribution toward realization of established goals. It is, therefore, necessary to make analyses of the future situation without and with the project in existence.

The costs of action proposed consist of those expenditures over and above the costs incurred in 1960. They cover costs of initial investment and the annual expenditures required for operation, maintenance, and replacements. For eval-

ation of the merits of a program or project, the investment and annual operation, maintenance, and replacements costs are expressed as annual equivalent costs based on a 50-year period of analysis.

Benefit-cost estimates, in some instances, are based on costs of production achieved in similar areas under comparable conditions. For example, an analysis of data available from Louisiana reveals that with development it would be feasible to increase the average annual yield of oysters from 50 bushels per acre to 105 bushels per acre. Additional information was obtained by comparing the yield of oysters from 2,400 acres of producing reefs in Apalachicola Bay, Florida, during the years 1958, 1959, and 1960.

Statistics with reference to the potential yield of shrimp in salt-water ponds made available by the Bears Bluff Laboratories, South Carolina Wildlife Resources Department, are employed.

It is assumed that continuing technological improvements will be able to reduce present unit operating costs, and costs of expanding current fishing operations to increase the catch of available fishes as indicated in the comprehensive plan will require increased expenditures equivalent to about 75 percent of the dockside value of the increased catch. The extent that technological improvements and changes in market prices match these assumptions will determine the extent to which the increased commercial fishing operations are expanded and should be reflected in future revisions of the plan.

Costs of supporting programs such as exploratory fishing and gear development, market development, and technological services are based on the planned expenditure of about 10 percent of the value of fish to be produced per year over the 1955-59 average.

These and other data employed in developing standard benefit-cost data of typical projects are summarized in Appendix 11, Engineering and Cost.

Comprehensive Plan

The formulation of the comprehensive plan involves a review of the overall needs for leisure time, food, and fiber and the role which fish and wildlife resources could play toward meeting these needs. Areas of compatibility and mutual

benefit are identified as the basis for planning multiple function projects thereby maximizing net benefits. Areas of conflict are recognized in order that appropriate action may be taken to prevent loss within the area of project influence or to make such adjustments as are necessary in the single-purpose fish and wildlife plan to compensate for prospective damages.

Terminal studies were conducted by several agencies to obtain the necessary information to prepare the comprehensive plans. Those dealing with the impact of reservoir projects on fish and wildlife were conducted by the U. S. Bureau of Sport Fisheries and Wildlife, U. S. Bureau of Commercial Fisheries, and the Georgia Game and Fish Commission. The U. S. Bureau of Sport Fisheries and Wildlife also conducted a terminal study on the effects and future implications of forestry practices on wildlife production and utilization in the Southeast River Basins area. The procedure followed in reporting upon the impact of multiple-function reservoir projects in sport fish and wildlife studies is as follows:

(1) Requirements for fish and wildlife resources in the target years are reviewed.

(2) The capacity of each of the reservoir projects at a specified level of management is estimated.

(3) The user-days of an area without development reflect the general rate of increased utilization as projected for the basin unless otherwise limited by the capacity of the habitat within the area of project influence. Estimates of use with the project are made by distributing the user-day requirements to each project until satisfied or until the rated capacity of the projects has been committed. In those instances where the user-days capacity exceeds requirements, use is prorated in accordance with the percent capacity of a given project to the total of all projects. Occasionally adjustments are made in the pro rata use of selected projects to reflect the influence of characteristics other than capacity such as distance from metropolitan areas, unusual attractiveness of the setting, and productivity of the reservoir waters.

(4) Values ascribed to use without and with the project are based on standard unit values adopted at the onset of the studies.

(5) Benefits derived from a given project are derived by computing the difference between use and value with the project as compared to that without.

(6) Additional costs of facilities required to derive the estimated benefits including mitigation of losses where feasible are added to the total costs of the project.

(7) A share of the total costs are allocated to fish and wildlife resource development in accordance with the separable costs-remaining benefits method.

(8) Fish and wildlife costs are then further allocated to reflect the share to be borne by Federal and non-Federal interests.

The merits of a single or multiple function project are generally determined on the basis of a comparison of tangible benefits to costs. Intangibles, however, are also considered and, in a few instances, provide the basis for deletion of some projects and adoption of others.

A comparison of costs per user-days fishing as could be provided by several types of projects

helped to determine the least expensive alternative.

Phasing or scheduling a project for action is based primarily on its economic feasibility, urgency of need, and opportunity for development.

Special note should be taken that the comprehensive plan includes developments that contribute to meeting the needs projected to the year 2000. Fish and wildlife developments existing or under construction as of 1960 are an essential part of the plan to meet needs. Benefits and costs are evaluated only for the increment of the plan to be developed during the period 1960-2000.

Plans for individual basins provide user-day totals that are sometimes slightly above or below basin needs, and the totals for the Southeast River Basins are about 2 percent short of the projected goals. Some of these variations involve planned interbasin uses. The other shortages can be met, within the limits of the available resources, when refined studies to that degree of precision are warranted.

TABLE 2.63
Summary of Fish and Wildlife Benefits and Costs
(thousands of dollars)

	Benefits Annual equivalent	Costs				OM&R at 2000					
		Annual equivalent		Investment	Invest- ment						
		Total	OM&R								
Savannah											
Multiple purpose											
Highlands	838.1	784.2	606.7	177.5	5,342.1	924.8					
Horsepasture	*(-3.8)										
Jocassee	20.6	20.0	2.3	17.7	490.8	2.3					
Newry-Old Pickens	85.9	72.1	7.9	64.2	1,782.0	7.1					
Chattooga	*(-20.8)										
Tallow Hill	60.5	62.6	5.6	57.0	1,583.2	5.6					
Trotters Shoals	98.8	39.8	6.1	33.7	933.3	6.1					
Anthony Shoals	48.7	43.0	6.0	37.0	1,027.4	6.0					
Lower Savannah	486.2	660.3	49.7	610.6	21,722.6	59.4					
Water access	89.0	87.9	41.3	46.6	1,289.6	41.3					
Subtotal	1,727.8	1,769.9	725.6	1,044.3	34,171.0	1,052.6					
Single purpose											
Wildlife	1,367.0	947.0	915.0	32.0	1,328.0	1,422.0					
Sport fisheries	2,916.0	1,662.0	1,655.0	7.0	712.0	2,570.0					
Commercial fisheries	352.0	299.0	297.0	2.0	60.0	530.0					
Subtotal	4,635.0	2,908.0	2,867.0	41.0	2,100.0	4,522.0					
Total	6,362.8	4,677.9	3,592.6	1,085.3	36,271.0	5,574.6					

(continued)

TABLE 2.63—Continued

	Benefits Annual equivalent	Costs				Invest- ment	OM&R at 2000		
		Annual equivalent							
		Total	OM&R	Investment					
Ogeechee									
Multiple purpose									
Groveland	191.3	180.3	18.1	162.2	4,519.0	18.3			
Water access	29.0	28.7	18.1	10.6	293.4	18.1			
Subtotal	220.3	209.0	36.2	172.8	4,812.4	36.4			
Single purpose									
Wildlife	238.0	55.0	48.0	7.0	316.0	161.0			
Sport fisheries	369.0	124.0	117.0	7.0	280.0	178.0			
Commercial fisheries	1,195.0	912.0	905.0	7.0	217.0	1,606.0			
Subtotal	1,802.0	1,091.0	1,070.0	21.0	813.0	1,945.0			
Total	2,022.3	1,300.0	1,106.2	193.8	5,625.4	1,981.4			
Altamaha									
Multiple purpose									
Big Flat Creek	3.0	3.2	0.5	2.7	73.4	0.9			
New Bethel	3.0	2.5	0.6	1.9	51.0	0.6			
Curry Creek	13.6	13.1	2.1	11.0	307.3	2.1			
Laurens Shoals	60.0	63.4	7.2	56.2	1,558.7	7.4			
Peachstone	15.8	14.2	1.4	12.8	353.4	1.4			
Goose Creek	220.0	214.1	21.5	192.6	5,365.3	22.7			
Coopers Ferry	230.0	224.3	32.3	192.0	5,349.5	33.2			
Abbeville	265.8	265.8	33.5	232.3	6,453.7	33.5			
Water access	70.0	65.3	31.3	34.0	939.0	31.3			
Subtotal	881.2	865.9	130.4	735.5	20,451.3	133.1			
Single purpose									
Wildlife	1,611.0	663.0	652.0	11.0	390.0	989.0			
Sport fisheries	1,602.0	1,186.0	1,166.0	20.0	720.0	1,996.0			
Commercial fisheries	230.0	219.0	194.0	25.0	270.0	352.0			
Buffalo Creek	112.0	104.0	24.0	80.0	2,500.0	24.0			
Subtotal	3,555.0	2,172.0	2,036.0	136.0	3,880.0	3,361.0			
Total	4,436.2	3,037.9	2,166.4	871.5	24,331.3	3,494.1			
Satilla-St. Marys									
Multiple purpose									
Big Satilla	135.2	110.1	9.1	101.0	2,799.8	9.1			
Axson	141.6	89.7	8.8	80.9	2,240.1	8.8			
Nassau	782.0	170.2	63.3	106.9	2,957.3	63.3			
Upper Hurricane	122.4	96.5	8.4	88.1	2,436.8	8.4			
Broxton	7.5	5.7	2.2	3.5	95.0	2.2			
Water access	63.0	61.7	33.2	28.5	788.8	33.2			
Subtotal	1,251.7	533.9	125.0	408.9	11,317.8	125.0			
Single purpose									
Wildlife	465.0	488.0	441.0	47.0	1,550.0	633.0			
Sport fisheries	873.0	344.0	306.0	38.0	1,505.0	398.0			
Commercial fisheries	1,090.0	735.0	731.0	4.0	215.0	1,253.0			
Subtotal	2,428.0	1,567.0	1,478.0	89.0	3,270.0	2,284.0			
Total	3,679.7	2,100.9	1,603.0	497.9	14,587.8	2,409.0			

(continued)

TABLE 2.63—Continued

	Benefits Annual equivalent	Costs				Invest- ment OM&R at 2000	
		Annual equivalent					
		Total	OM&R	Investment			
Suwannee							
Multiple purpose							
Franks Creek	6.7	3.0	0.8	2.2	62.9	0.8	
Tifton	24.6	24.4	8.9	15.5	430.7	8.9	
Hixtown Marsh	44.3	42.7	10.3	32.4	904.0	10.2	
Moultrie	11.9	8.2	1.6	6.6	181.7	1.7	
Mud Swamp	16.6	13.3	4.9	8.4	229.8	5.1	
Quitman	71.7	53.9	14.8	39.1	1,080.4	14.8	
Nashville	93.2	38.0	8.8	29.2	807.3	8.8	
Shiloh	117.1	68.3	17.4	50.9	1,422.0	18.0	
Ashburn	25.7	19.7	7.5	12.2	340.3	7.5	
Alapaha	111.1	107.6	26.8	80.8	2,237.2	26.8	
Water access	140.0	137.6	66.7	70.9	1,959.8	66.7	
Subtotal	662.9	516.7	168.5	348.2	9,656.1	169.3	
Single purpose							
Wildlife	923.0	631.0	631.0	0	0	943.0	
Sport fisheries	974.0	699.0	692.0	7.0	350.0	1,070.0	
Commercial fisheries	130.0	108.0	106.0	2.0	68.0	196.0	
Subtotal	2,027.0	1,438.0	1,429.0	9.0	418.0	2,209.0	
Total	2,689.9	1,954.7	1,597.5	357.2	10,074.1	2,378.3	
Ochlockonee							
Multiple purpose							
Doerun	5.0	3.1	0.7	2.4	63.1	0.7	
Quincy	5.7	4.3	0.9	3.4	94.2	1.0	
Thomasville	48.0	37.9	9.5	28.4	791.4	10.0	
Tired Creek	20.8	13.1	2.7	10.4	285.7	2.7	
Gulf Coast Improvement	233.0	224.8	45.5	179.3	4,978.7	46.2	
Steinhatchee	4.0	4.0	0.2	3.8	106.5	0.2	
Wacissa	13.5	13.4	6.1	7.3	204.1	6.1	
Water access	73.0	72.0	36.7	35.3	974.7	36.7	
Subtotal	403.0	372.6	102.3	270.3	7,498.4	103.6	
Single purpose							
Wildlife	255.0	223.0	216.0	7.0	341.0	353.0	
Sport fisheries	694.0	240.0	224.0	16.0	730.0	367.0	
Commercial fisheries	318.0	232.0	227.0	5.0	194.0	400.0	
Subtotal	1,267.0	695.0	667.0	28.0	1,265.0	1,120.0	
Total	1,670.0	1,067.6	769.3	298.3	8,763.4	1,223.6	
Apalachicola-Chattahoochee-Flint							
Multiple purpose							
Anneewakee	212.7	197.2	63.5	133.7	3,720.0	45.3	
Cedar Creek	98.7	68.9	11.1	57.8	1,600.0	11.3	
West Point	130.1	108.5	14.1	94.4	2,619.3	14.1	
Dog River	56.0	45.7	8.8	36.9	1,000.0	8.8	
Spewell Bluff	100.5	85.8	12.1	73.7	2,050.5	12.3	
Lazer Creek	58.9	38.4	5.8	32.6	905.5	5.8	
Lower Auchumpkee	79.8	71.3	10.7	60.6	1,682.9	10.8	
Lower Flint	160.7	160.7	25.6	135.1	3,738.9	25.6	
Kinchafoonee	5.8	5.5	1.7	3.8	106.2	1.8	
Muckalee	8.1	7.8	0.7	7.1	193.9	0.8	
Omussee Creek	15.0	13.0	2.8	10.2	283.8	2.8	

(continued)

TABLE 2.63—Continued

	Benefits Annual equivalent	Costs				OM&R at 2000	
		Annual equivalent			Invest- ment		
		Total	OM&R	Investment			
Chipola River	33.0	9.5	8.0	1.5	527.0	8.4	
Middle Chattahoochee	41.8	49.3	11.3	38.0	1,068.6	11.3	
Water access	154.0	151.5	77.0	74.5	2,061.6	77.0	
Subtotal	1,155.1	1,013.1	253.2	759.9	21,558.2	236.1	
Single purpose							
Wildlife	2,910.0	1,393.0	1,335.0	58.0	1,620.0	1,599.0	
Sport fisheries	7,640.0	4,455.0	3,231.0	1,224.0	33,929.0	4,254.0	
Commercial fisheries	892.0	773.0	764.0	9.0	240.0	1,033.0	
Apalachicola Bay	1,307.0	787.0	766.0	21.0	430.0	766.0	
Subtotal	12,749.0	7,408.0	6,096.0	1,312.0	36,219.0	7,652.0	
Total	13,904.1	8,421.1	6,349.2	2,071.9	57,777.2	7,888.1	
Choctawhatchee-Perdido							
Multiple purpose							
Crestview	691.4	554.1	83.6	470.5	13,021.4	83.6	
Ariton	79.6	44.1	4.9	39.2	1,088.7	4.9	
Deadening Lakes	163.8	163.2	109.1	54.1	1,503.2	120.2	
Fishing lakes	61.0	18.1	17.1	1.0	29.0	17.1	
Water access	70.0	68.4	43.3	25.1	695.1	43.3	
Subtotal	1,065.8	847.9	258.0	589.9	16,337.4	269.1	
Single purpose							
Wildlife	1,912.0	894.0	846.0	48.0	1,690.0	3,062.0	
Sport fisheries	3,813.0	1,367.0	1,264.0	103.0	5,152.0	3,865.0	
Commercial fisheries	857.0	338.0	334.0	4.0	170.0	1,329.0	
Subtotal	6,582.0	2,599.0	2,444.0	155.0	7,012.0	8,256.0	
Total	7,647.8	3,446.9	2,702.0	744.9	23,349.4	8,525.1	

* Not included in totals.

Bibliography

Prepared for U. S. Study Commission, Southeast River Basins:

U. S. Department of the Interior. *Special Studies Technical Memorandum for Fish and Wildlife*, prepared by Bureau of Sport Fisheries and Wildlife, Atlanta, Georgia, from an array of data and reports submitted by State game and fish agencies, U. S. Bureau of Commercial Fisheries, and U. S. Bureau of Sport Fisheries and Wildlife.

Ochlockonee Basin	— May 1961
Choctawhatchee-Perdido Basins	— June 1961
Savannah Basin	— August 1961
Altamaha Basin	— September 1961
Apalachicola Basin	— September 1961

U. S. Department of the Interior. *The Effects and Future Implications of Forestry Practices on Wildlife Production and Utilization in the Southeast River Basins*, Bureau of Sport Fisheries and Wildlife, December 1961.

Selected references used but not prepared for the Commission:

Alabama Department of Conservation:
A Game Inventory of Alabama, Frederick S. Backalow,

Jr., Game, Fish, and Seafoods Division, 1949, 140 pp.
Alabama Hunting and Fishing are Big Business, (A summary of a study by Crossley, S-D, Inc., New York, N. Y., 1956) 1956, Montgomery, Alabama.

Byrd, I. B. *Angling Success and Seasonal Distribution of Catch in Alabama's State-Owned Public Fishing Lakes*, Transactions—24th North American Wildlife Conference, 1959, pp. 225-237.

Florida Development Commission. *Tourist Studies in Florida*, 1959, Tourist Services Division, Carlton Building, Tallahassee, 1960, 16 pp.

Florida Game and Fresh Water Fish Commission:
A Decade of Game Management in Florida, Tallahassee, 1960, 15 pp.

The Effect of Food Plantings, Climate Conditions, and Land Use Practices Upon the Quail Population of an Experimental Area in Northwest Florida, Robert Murray, Game Management Division, Tallahassee, 1958.

Florida's Wildlife Management Areas, Game Management Division, Tallahassee, 1955.

Public Hunting Problems in Florida With Special Reference to the Northwest Region, Tallahassee, 19 pp.

Florida State Board of Conservation:

A Survey of the Number of Anglers and of Their Fishing Effort and Expenditures in the Coastal Recreational Fishery of Florida, Robert W. Ellis, Albert Rosen, and Alan W. Moffett, The Marine Laboratory, University of Miami, Virginia Key, Miami 49, Florida, 1958, 50 pp.

Oyster and Clam Culture in Florida, Robert M. Ingle, Division of Oyster Culture, Educational Series No. 5, Tallahassee, 25 pp.

Oyster Culture in Florida, Robert M. Ingle and F. G. Walton Smith, Division of Oyster Culture, Educational Series 5, Tallahassee, 1956, 26 pp.

Georgia State Game and Fish Commission:

Game Resources of Georgia, J. H. Jenkins, Game Management Division, Atlanta, 1953, 114 pp.

Georgia Fish and Fishing, Howard D. Zellar, Fisheries Research Supervisor, Atlanta, 1960, 37 pp.

Inter-Agency Committee on Water Resources. *Report of the Panel on Recreational Values on a Proposed Interim Schedule of Values for Recreational Aspects of Fish and Wildlife*, E. H. Wiecking, Chairman, Subcommittee on Evaluation Standards, Washington: 1960, 3 pp.

Luntz, G. Robert. *Pond Cultivation of Shrimp in South Carolina*, Proc. of the Gulf and Caribbean Fisheries Institute, Tenth Annual Session, November, 1957, pp. 44-48.

Osterbind, Carter C. and Elise C. Jones. *Florida's Commercial Fisheries; Markets, Operations, Outlook*. Bureau of Economic and Business Research, College of Business Administration, University of Florida, Gainesville, 1955, 160 pp.

Outdoor Recreation Resources Review Commission:

Hunting in the United States — Its Present and Future Role (prepared for ORRRC by the Department of Conservation, School of Natural Resources, the University of Michigan) ORRRC Study Report 6, Washington: U. S. Government Printing Office, 1962, 117 pp.

Sports Fishing — Today and Tomorrow (prepared for ORRRC by Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior) ORRRC Study Report 7, Washington: U. S. Government Printing Office, 1962, 130 pp.

Surber, Eugene. *Suggested Methods for Reporting Fish Population Data From Reservoirs*, Proc. Thirteenth Annual Conference Southeastern Association Game and Fish Commissioners, 1959, pp. 313-325.

Swingle, H. S. *Fish Populations in Alabama Rivers and Impoundments*, Transactions — American Fisheries Society, 1954, pp. 47-57.

U. S. Congress, Senate. *Fishery Resources of the United States*: Letter of the Secretary of the Interior transmitting pursuant to law, a report on a survey of the fishery resources of the United States and its possessions, March, 1945; Washington: U. S. Government Printing Office, 1945, 135 pp.

U. S. Congress, Senate. *Water Resources Activities in the United States: Fish and Wildlife and Water Resources*, Select Committee on National Water Resources, Commit-

tee Print No. 18, Washington: U. S. Government Printing Office, 1960, 69 pp.

U. S. Department of Agriculture:

Food — The Yearbook of Agriculture, 1959: Fish and the Fishing Industry, Andrew W. Anderson, Washington: U. S. Government Printing Office, 1960, pp. 353-370.

Managing Farm Fields, Wetlands, and Waters for Wild Ducks in the South, Verne E. Davidson and William W. Neely, Soil Conservation Service, USDA Farmers Bulletin No. 2144, Washington: U. S. Government Printing Office, 1959, 14 pp.

U. S. Department of Commerce. *Oyster Investigations in Georgia*, Paul S. Galtsaff and R. H. Luce, Oyster Fishery Investigations, Fishery Document No. 1077, Washington: U. S. Government Printing Office, 1930, 100 pp.

U. S. Department of the Interior:

Big Game Inventory for 1960, Bureau of Sport Fisheries and Wildlife, Wildlife Leaflet 440, Washington: 1961, 4 pp.

Fish and Shellfish of the South Atlantic and Gulf Coasts, Rachel L. Carson, Office of the Coordinator of Fisheries: Conservation Bulletin 37, Washington: U. S. Government Printing Office, 1950, 45 pp.

Fishery Statistics of the United States, 1958, E. A. Power, Division of Industrial Research and Services, Bureau of Commercial Fisheries, Statistical Digest 49; Washington: U. S. Government Printing Office, 1960, 424 pp.

The 1960 Salt Water Angling Survey, John R. Clark, Fishery Research Biologist, Bureau of Sport Fisheries and Wildlife, Circular 153, Washington: U. S. Government Printing Office, 36 pp.

Survey of Fishing in 1,000 Ponds in 1959, Willis King, Chief, Branch of Fishery Management Services, Bureau of Sport Fisheries and Wildlife, Circular 86, Washington: U. S. Government Printing Office, 1960, 20 pp.

Wetlands of the United States. Samuel P. Shaw and C. Gordon Fredine, Fish and Wildlife Service, Circular 39, Washington: U. S. Government Printing Office, 1956, 67 pp.

Virginia Fisheries Laboratory. *Let's Be Oyster Farmers*, Robert S. Bailey, Division of Planning and Economic Development, Richmond, Educational Series No. 8, 69 pp.

Wildlife Management Institute. *Mourning Dove Populations in the Southeast River Basin Area*, Technical Report to U. S. Department of the Interior, Fish and Wildlife Service, June 1961.

Wood, Roy K. and Whelan, Donald. *Low-Flow Regulation as a Means of Improving Streams for Fishing*, Proc. of the Sixteenth Annual Conference Southeastern Association Game and Fish Commissioners, 1962.

Supplemental Data

The work plan which is referred to earlier in this Section follows. Other pertinent data on fish and wildlife resources are contained in the files of the U. S. Study Commission, Southeast River Basins.

WORK PLAN - FISH AND WILDLIFE

(edited to delete administrative details)

I. Introduction

The preservation, protection, and enhancement of fish and wildlife resources were specifically acknowledged in the provisions of Public Law 85-850 as one of several basic functions of land and water resource development to be studied by the Commission. This is significant. As natural products of land and water, fish and wildlife have been usually treated incidentally to other functions in river basin development.

In recent years, however, the demand for fish and wildlife resources has become so great and the supply so restricted that incidental consideration is not enough. Deliberate and careful planning, coordinated with all programs of land and water resource development will be essential if the best public interest is to be served.

II. Objective

The primary objective of the Commission is to prepare a comprehensive plan for the development and utilization of the land and water resources of the Southeast River Basin with a view toward securing the maximum contribution of these resources to the general economy and welfare of the region, and the nation. Provision will be made in this plan for development of fish and wildlife resources in order to assure their optimum, sustained use within the basin.

III. Guidelines

Fish and wildlife studies to be undertaken by the Commission with the assistance of other Federal, State, and private agencies fall into four major categories—

1. Determination of the needs and preferences for fish and wildlife resources by the people, now and in the future;
2. Appraisal of the capacity of fish and wildlife resources to "meet the needs";
3. Appraisal of the obstacles and opportunities relative to "meeting the needs"; and
4. Formulation of an action program.

Studies, for the most part, will be extensive rather than intensive in nature. On the other hand, we do wish to establish a frame within which detailed studies may be conducted when necessary.

The Commission will employ data which for the most part are or may be made available by cooperating agencies. Data will be compiled by States, sub-basins, physiographic provinces (wildlife resource areas) and, when appropriate, by counties. While considerable data have been obtained by various agencies for their administrative use, little has been compiled or published in a form that will readily serve the proposed studies. Moreover, it is likely that special studies will be required to close breaks in the available data.

Emphasis will be given to meeting the needs of the human population, now and in the future. Target years for specific consideration in planning are 1975 and 2000.

Needs of the people will be reflected in terms of outdoor recreational requirements, food, and fiber; possible solutions in terms of resource development. Tangible and intangible values will be appraised.

IV. Technical Tasks

For administrative reference and as a guide to the cooperating agencies, fish and wildlife studies have been broken down into a series of principal tasks. The scope of each task is briefly described; although they will not necessarily be undertaken in the listed order. Detailed work plans will be prepared for each task. Within the framework of these detailed plans the cooperating agencies will devise procedures for collecting and assembling the required information.

The studies have been designed in such manner that a technical memorandum may be prepared for each task.

Task 1.—Introductory Materials—Material to be assembled for this task will be used in introducing the findings of the Southeast River Basin Studies. The general importance of fish and wildlife resources to the national economy will be described and related to contributions made by fish and wildlife resources within the study area.

Task 2.—Current and Future Requirements for Fish and Wildlife Resources—The objective of this task is to determine the current and future demand, preference, and utilization of fish and wildlife resources by the people for the purpose of meeting basic requirements for outdoor recreation, food, and fiber. Assumptions as to trends in economic activity and population increase will be based on special studies being conducted by the Commission. Assumptions as to the numbers of hunters and fishermen, their preferences for various species of game and quality of sport, and the pressure which they exert on the available resources will be based on data provided by such surveys as the National Survey of Fishing and Hunting, sampling surveys conducted by the cooperating agencies, sale of hunting and fishing licenses, and other special studies. Estimates of current consumption of various fish and wildlife products and potential requirements also will be made within this framework.

Task 3.—Appraisal of Fish and Wildlife Habitat—This study will provide the basis for an appraisal of the capacity of fish and wildlife resources to meet current and future demands in terms of habitat, the effects of various factors on the capacity and utility of the habitat, and the significance of habitat trends from the standpoint of increasing or diminishing future potentials.

Task 4.—Appraisal of Fish and Wildlife Populations and Their Use—This study will provide the basis for an appraisal of adequacy of fish and wildlife resources to meet current and future requirements in terms of existing and anticipated fish and wildlife populations. Particular consideration will be given to individual species and groups of major importance from the standpoint of quantity and quality of recreation and/or food provided; in other instances, emphasis will be placed on the need for the preservation of rare or vanishing species.

Task 5.—Appraisal of Fish and Wildlife Programs and Facilities—This study will involve an inventory of major fish and wildlife facilities under the jurisdiction of Federal, State, and local interests. Emphasis will be placed on the appraisal of the adequacy of these facilities and related programs to meet current and future demands. Major obstacles and opportunities will be evaluated as the basis for orienting future programs.

Task 6.—Formulation of Action Program—This task will provide for the over-all analysis of data provided by Tasks 2–5 and formulation of an action program. Trends will be analyzed in relation to other programs of land and water resource development and evaluated with respect to their impact on the future supply, demand, and availability of fish and wildlife resources.

Future goals in terms of habitat, fish and wildlife populations, and facilities will be established and the adequacy of existing and planned programs and developments to meet these goals evaluated.

Solutions to key problems and means of securing maximum contributions will be explored and elements selected for analysis and inclusion, if economically feasible and practicable, in a functional plan for fish and wildlife development.

Task 7.—Standards and Definitions—The objective of this task is to standardize, collate, and assemble in one place all definitions and units of measure used in the over-all study of fish and wildlife resources. Each detailed work plan will also contain definitions and standards pertinent to the subject matter of that task.

Task 8.—Other Work—To fill breaks in available data, some special studies may be required. Detailed work plans for each such study will be prepared when and if found necessary by the Commission.

V. Technical Programming

The work required for the accomplishment of each task shall, in most instances, involve the participation of more than one agency. Furthermore, the completion of one study may be dependent upon information made available by another. It is therefore imperative that studies proceed concurrently and that free interchange of data be encouraged between the cooperating agencies. However, to insure coordination and prevent duplication of effort, requests for data between agencies should be routed through the Commission.

A sub-work group will be organized for the purpose of assisting in the preparation of detailed work plans, in the compilation and analysis of basic data, and in the preparation of technical memoranda. It will be composed of representatives of the agencies actively participating in fish and wildlife studies and any consultants who may be invited to attend.

The results of each task will be reviewed and summarized in the form of a technical memorandum to be prepared by the Commission staff or agency to whom such responsibility is assigned.

Schedules depicting work to be performed, possible

agency assignments, target dates for completion of studies, and estimated costs will be attached to this work plan following further coordination with the cooperating agencies.

TECHNICAL SUPPLEMENT TO WORK PLAN — FISH AND WILDLIFE

(edited to delete administrative details)

Task 1—Introductory Materials (Prepared by the Study Commission Staff with Advice from Cooperating Groups)

The introductory material will be a narrative description of the fish and wildlife resources in the Southeastern area. The information will be summarized from the detailed studies in Tasks 2–6 and from other reference material. The narrative description will cover (1) resources in brief qualitative terms by basins; (2) status of development within each basin, including a comparison with development in other basins in the Southeast and with the Study Area as a whole; (3) contribution of fish and wildlife to the general welfare and economy at the local, regional, and national levels; (4) potentials and probabilities of development.

The summarized narrative material will cover the following subjective groupings:

- A. Fresh water fisheries
 - 1. Sport
 - 2. Commercial
- B. Salt water fisheries
 - 1. Sport
 - 2. Commercial
- C. Wildlife
 - 1. Big game, small game, and fur animals
 - 2. Waterfowl
 - 3. Other wildlife

Task 2.—Current and Future Requirements (Needs and Desires)

- A. Economic projections, 1975 and 2000 (by USSC)
 - 1. Population development: Relate population development to historic importance of fish and wildlife resources.
 - 2. Population characteristics: Relate trends in segments of the population, such as urban and rural, age classes, etc. to the historic need for fish and wildlife resources.
 - 3. Population projections: Summarize data to be employed in fish and wildlife studies.
 - 4. Economic outlook: Cite general assumptions as to future economy which will be employed in developing specific assumptions as to demand for fish and wildlife resources.
 - 5. Report: Prepare narrative (Technical Memorandum)
- B. Demand for fishing and hunting opportunity, now and in 1975 and 2000 (by states and USSC)
 - 1. Current demand: Assist the USSC to analyze the 1955 National Survey of Hunting and Fishing, adapt data and estimate hunting and fishing pres-

sure (man-days) expended in the SERB, in 1955, by basin and state.

2. Trends: Analyze license sales as index to trends and distribution of demand.
 - a. Number: Determine number of hunting and fishing licenses and duck stamps sold in each State for selected years of record.
 - b. Distribution: Determine number of licenses sold in each county within that part of each State in SERB during license year 1959-60; total and subtotal by basins and State. Prepare maps showing relative numbers of licenses sold in each county.
 - c. Analysis of data: Compare trends in total license sales with trends in total urban and rural population. Review changes in license structure, costs, etc., which have bearing on trends. Compare resident and non-resident sales, etc.
 - d. Isolate key factors influencing past sales and evaluate future implications.
3. Future demand, 1975 - 2000
 - a. Basic assumptions: Assist the USSC in developing a framework of basic assumptions against which the future demand may be projected and formulae developed for the conversion of population data (Task 2-A) into man days.
 - b. Projections: Determine man days of hunting and/or fishing by type; total and subtotal by basins and states.
4. Prepare narrative (Technical Memorandum)

C. Demand for fish consumed as food, manufactured, and utilized for bait and other purposes, now and in 1975 and 2000 (by BCF)

1. Food (in US, SERB)
 - a. Current demand: Analyze available data and express demand in pounds of fin fish and shell fish consumed as food by total human population, per capita during most recent year of record.
 - b. Trends: Study trends in total and per capita consumption of fin fish and shell fishes as basis for predicting future demand.
 - c. Future demand, 1975 and 2000: Establish basic assumptions as to future demand per capita, compute total consumption.
2. Manufactured products (in US)
 - a. Current demand: Analyze available data and express demand in terms of total pounds of fish manufactured into meal, oil, fish solubles, homogenized, condensed fish, etc., in the U. S.
 - b. Trends: Describe trends as index to future demand.
 - c. Future demand, 1975 and 2000

Establish basic assumptions as to future need by projected population (See Task 2-A) and estimate total pounds of fish or manufactured products required.
3. Bait and other (by Basins)
 - a. Current demand: Analyze available data and express demand in terms of pounds or value of fish utilized for bait by sport and commercial fishermen. If statistics available total and subtotal by basins, states, and SERB.

b. Trends: Discuss recent trends in demand as basis for predicting future demand.

c. Future demand, 1975 and 2000. Make assumptions as to future demand (See 2-A and B) and estimate the relative magnitude of supplies which will be needed.

4. Prepare narrative (Technical Memorandum)

D. Demand for wildlife manufactured into furs and other products now and in 1975 and 2000 (BSF&W)

1. Furs (United States)
 - a. Current demand: Analyze available data and express demand in terms of total pelts manufactured into fur garments or similar products by species or major groups.
 - b. Trends: Describe trends as index to future demand.
 - c. Future demand, 1975 and 2000: Make assumptions as to future demand (See population projections, 2-A) and estimate relative increase in number of pelts required.
2. Other: Mention other uses.
3. Prepare narrative (Technical Memorandum)

E. Special Needs: There are some requirements or needs for fish and wildlife resources which cannot be expressed as demands, such as the preservation of unusual habitats and basic supplies of certain species. Describe these needs as the basis for plan development. (BSF&W; BCF; States)

Tasks 3 and 4 – Appraisal of Resources (Habitat and Populations)

A. Fresh water fish (By states and BSF&W)

1. Habitat
 - a. Extent and distribution by type: The Bureau of Sport Fisheries and Wildlife will prepare a map depicting the extent and location of water bodies by general type, and compile acreage and stream mile data, totaled and subtotalled by States, basins, and physiographic provinces. This map and acreage data will be made available to other cooperating agencies.
 - b. Quality of Habitat: Delineate on map those waters of high, moderate, and low value from the standpoint of production of characteristic forms of fish and/or degree of utilization by fisherman. Use colors and Roman Numerals I, II, III, to indicate value in descending order. Water bodies of potential value which have been detrimentally affected by pollution should be designated as Class IV. Waters of negligible value should not be colored.
2. Existing populations: By tables or diagrams depict the dominant species or group composition of fishes in representative bodies of water based on available sample data. Seasonal migrations of important species into waters under consideration should be described. Example: Rock Fish.

3. Use of Resources

- a. Sport Fishing: Describe the extent (total man days) of sport fishing within each basin, species caught, where the major effort is expended (cite specific bodies of water or habitat types), methods of fishing, by whom (local, state, or out-of-state residents) and when (seasons of the year).
- b. Commercial fishing: Describe the extent of commercial fishing within each basin, species harvested, where the major effort is expended, and relative economic importance of the catch. Describe the extent to which the catch is utilized and for what purposes; define the market area for fishes caught within the basin.

4. Capacity: Rate the capacity of the resources under present conditions to satisfy or sustain additional use for sport and commercial purposes.

5. Trends: Describe those trends in land use and economic development which will increase or decrease the capacity of the resources.

6. Conclusions. Draw key conclusions as to the capacity of the resources to satisfy demands within each basin, outside each basin (see Task 2), now and in 1975 and 2000.

7. Prepare Narrative

B. Salt water fish (by BCF)

1. Habitat
 - a. Extent and distribution: Describe extent and distribution of inshore and offshore waters by type (miles of shoreline, etc.), total and subtotal by basins and States.
 - b. Quality of Habitat: Describe and if feasible delineate on map those waters of high, moderate, and low value from the standpoint of production of characteristic forms of fin fish and shell fish and/or utilization for sport and/or commercial fishing. Use color scheme and Roman Numerals I, II, III to indicate value in descending order. Waters of potential value which have been detrimentally affected by pollution or other economic development should be designated as class IV. Waters of negligible value should not be colored.
2. Existing Populations: Describe the distribution and relative abundance of dominant species to be found within the area of basin influence with particular reference to those fishes found in estuarine waters or which seasonally migrate up the river systems. Appraise the extent to which the habitat is stocked (Example: Oysters)
3. Use of Resources
 - a. Sport Fishing: Describe the extent (total man days if available) of sport fishing within each basin, where the major effort is expended (cite specific water masses or sites), principal modes of fishing (charter boat, party boat, pier, etc.), by whom (local, state, or out-of-state residents), and when (seasons of the year). Describe principal factors influencing mode of fishing, quality of experience, success, convenience, cost, etc.
 - b. Commercial Fishing: Describe the extent of commercial fishing within each basin in terms of numbers of fishermen engaged, craft and gear employed, total catch by selected species, and value of catch. Tabulate supporting data. Also describe where the major effort is expended and when (seasons of year). Discuss extent and purposes to which the catch is being utilized. Define the market area for fish landed and/or processed within the basin.
4. Capacity: Rate the capacity of the resources under existing conditions to satisfy or sustain additional use for sport and commercial fishing purposes.
5. Trends: Describe those trends in land use and economic development which will increase or decrease the capacity of resources.
6. Conclusions: Draw key conclusions as to the capacity of the resources to satisfy the demand (see Task 1) within and outside each basin, now and in 1975 and 2000.
7. Prepare Narrative

C. Wildlife (big game, small game, and fur animals by States, waterfowl (by BSF&W)

1. Habitat
 - a. Extent and distribution by type: The Bureau of Sport Fisheries and Wildlife is preparing a map depicting the extent and location of habitat by types of land use; acreage data are being compiled and totaled and subtotalized by States, basins, and physiographic provinces. A map depicting the major forest cover also will be prepared. These maps and acreage data will be made available to the cooperating agencies for reference use.
 - b. Suitability of Habitat: Delineate on habitat map those lands and waters of high, moderate, and low value for the production of or utilization by waterfowl. Use colors to indicate relative value. Habitat of negligible value should not be colored. Compile acreage data by basins. Describe value of habitat by type and location for big game, small game, and fur animals.
2. Existing Populations: Appraise the extent to which the suitable habitat is stocked with big game, small game, fur animals, and waterfowl, in relation to estimated carrying capacity. Illustrate with maps depicting suitable habitat occupied and unoccupied by selected species. Example: deer, turkey, beaver. Seasonal concentrations of waterfowl should be described and mid-inventory data compiled depicting total populations by basins. Compare with Atlantic Flyway total for same year of record.
3. Use of Resources
 - a. Hunting: Describe the extent (man days) and location of hunting within each basin and pressure exerted on big game, small game, and

waterfowl resources. Describe the quality of sport provided. Discuss origin of hunting pressure; i.e. local, state, out-of-state. Relate hunting pressure to quality of habitat and sport afforded.

- b. Other Recreational Use. Describe the extent to which areas affording unusual opportunities to observe wildlife are visited by the public.
- c. Commercial Use: Describe the extent of fur trapping within the basin and pressure exerted on the fur resources of representative habitat types. Mention other commercial uses of wildlife resources.

4. Capacity: Rate the capacity of the resources under existing conditions to sustain additional use for hunting and trapping. (See table).

5. Trends: Describe those trends in land use and economic development which will probably increase or decrease the capacity of the resources in the future.

6. Conclusions: Draw key conclusions as to the capacity of the resources to satisfy the demand (see Task 2) within the basin and outside the basin, now and in 1975 and 2000. Prepare narrative.

Task 5 – Appraisal of Resources (Programs and Facilities – By All Cooperating Agencies)

A. Going programs: Prepare brief statement as to your agency's general field of interest, scope of activities, and primary objectives with respect to fish and wildlife conservation.

B. Surveys and investigations: Describe more specifically, surveys and investigations being undertaken in relation to key fish and wildlife problems and plans for development of resources.

C. Physical projects and facilities: Classify physical projects and facilities under management by your agency as to type, and show their location by appropriate symbol on base map. Example: Refuge, management area, fish hatchery, research stations.

D. Inventory of selected areas: Select fish and wildlife areas of major significance and minor projects which singularly or as a group are significant and compile data requested in inventory table (attached). Summarize by basins.

E. Trends: Describe significant trends in growth of programs in relation to public demand for services and use of fish and wildlife areas and facilities.

F. Conclusions: Draw key conclusion with respect to the capacity of programs and facilities to fulfill conservation objectives (See A above) and to satisfy the public demand (overall needs and desires), now and in 1975 and 2000.

Task 6 – Formulation of Action Program (All cooperating agencies)

A. Comparison of Needs and Available Resources: Briefly review the demand (overall needs and desires) for fish and wildlife resources by people residing within and without each basin (See Task 2) as compared to the

capacity of the resources (Tasks 3, 4, 5). Identify those resources by type and location (physiographic province) which are less than that required to meet the demand now and in 1975 and 2000, or which are affected by changes in land use and economic development.

B. Establish goals: Discuss current conservation policies with respect to increased use versus preservation of resources, weigh the issues, and establish goals in terms of proposed percent increase or decrease in use of resources, for sport and commercial purposes by basins and physiographic province. In dealing with special needs, goals should be established in terms of minimum wildlife populations to be maintained and/or specific areas to be preserved in their natural State.

C. Possible solutions: Describe primary problems and opportunities confronting the preservation, protection, and enhancement of resources to attain the established goals. Studies should be habitat oriented. When practicable, show location and extent of problems and opportunities on map. Example of problems: Segment of stream polluted; Example of opportunity: Site suitable for State or national wildlife management area.

Discuss alternate methods of resolving the problem and make a judgment appraisal as to the most feasible course of action. This may involve the acceleration of going programs and projects as well as the initiation of new ones.

D. The Fish and Wildlife Plan: Programs and projects which are found to be needed, feasible, and desirable should be grouped into two action phases: (1) for accomplishment by 1975, (2) for accomplishment by 2000. Within each of these phases, projects should also be grouped by type: i.e. (a) surveys and investigations, (b) land acquisition, (c) development, (d) extension, and (e) other.

Projects of a physical nature should be described as to type, purpose, location, extent (acreage or stream miles), general design, operation, benefits to be derived, and costs (initial costs and annual charges). Be as specific as practicable. Prepare letter size, project maps as appropriate. All dollar values of damages, benefits, and costs should be based on 1959 price levels.

Programs to be accelerated or initiated should be related to the problem or problems which they will help resolve. The intangible factors or institutional factors considered will be explained; also contributions expected in the nature of public benefits.

Task 7 – Standards and Definitions (by USSC)

The Commission staff will assemble all standards and definitions employed in the study as a guide to the cooperating agencies.

Task 8 – Other Work (USSC)

Collation and assembly of material (BSF&W). The Bureau of Sport Fisheries and Wildlife will assist the Commission staff in the correlation and assembly of material submitted by the cooperating agencies. This will include the combining of statistical data pertaining to the same subject by basins and physiographic provinces, the preparation and/or editing of technical memoranda by tasks, and the preparation of maps and other illustrative material.

SECTION XIII - RECREATION

General Concept

Recreation studies are conceived and applied mainly on the basis of a use concept. Use is expressed in terms of user-days. Recreation in the studies is confined to public outdoor recreation activities dependent upon land and water resources but exclusive of golf course and playground type of recreation. Hunting and fishing are recognized as forms of recreation but are identified separately and discussed in the Section on fish and wildlife.

To treat recreation on a basis comparable with other purposes in the plan, recreation developments must stand the usual tests and be subjected to the same types of analyses as are ordinarily applied to other purposes. Recreation as a purpose must consider both tangible and intangible benefits and costs.

For recreation studies the user-day is selected as a convenient unit of measurement reflecting the use of and the needs for recreation. Recreation boating is studied in terms of user-days rather than number of boats used.

For making an estimate of user-days, a review was made of available data primarily to define the significant and controlling factors influencing outdoor recreation. While many factors are known to have an influence, the following are the most significant: (1) Population; (2) mobility; (3) income; and (4) leisure time. Other factors noted, but not singled out for detailed study, include age, sex, occupation, place of residence, paid vacation, race, and education. These other factors have been continually reviewed as tempering influences.

The same estimates of population are used in recreation as in the other studies to maintain a common denominator in ascertaining needs or target figures to use as a basis for planning.

From a viewpoint of recreation, it is acknowledged that basin, State, and study area boundaries are not confining. Special studies confirm that the movement of people into and out of the basins for outdoor recreation are in balance, except for nonresidents passing through the basins. These nonresidents must receive special consideration, because many of them partake of some

forms of recreation during the period they are in the study area.

A mobile populace has a great range in which recreation opportunity can be obtained. This relates to the mode of transportation and its flexibility as to time and direction. Automobile travel is by far the greatest influence on outdoor recreation.

Work Plan

One of the first steps taken in planning for recreation in the Southeast River Basins was the development of the work plan. The work plan itself was never altered in a formal revision, although some minor modifications were necessary as dictated by the conditions existing and discovered during the progress of the studies. A copy of the work plan is included at the end of this Section.

Work Performance

To carry out the items as outlined in the work plan, many sources of information were used. It was recognized early in the formulation period that no single agency was in the position to perform all the tasks necessary within the time and funds available.

Commission

Methods, goals, definitions, costs, values, standards, and criteria were developed for use in the plan. Supplemental material at the end of this Section contains details. No adequate inventory for the Southeast River Basins was available.

An inventory of existing recreation resources was made with the cooperation of State and Federal agencies. A copy of the inventory data sheet is included at the end of this Section. This inventory is not all inclusive in that many recreation areas of a private, local, and county nature are not included. However, use, size, and other general information reflects an estimate of magnitudes of these existing areas. Estimates have been made of several areas where no other information was available.

Unit values were developed which would permit cost and benefit estimates for recreation

projects. These costs are discussed in greater detail in Appendix 11, Engineering and Cost. The benefits are discussed at greater length under Findings in this Section and appear also in Appendix 9, Part Four, Table 4.1.

Agreements

In response to the need for information on unusual areas in the Southeast River Basins, the National Park Service supplied names and descriptions of historic, archeological, and natural sites which the inventory did not cover. This study, called the "Unusual Area Study," lists areas and sites, many of which are incorporated in the plan for the development of recreation.

The National Park Service was requested to suggest a plan for the development of recreation from the single-purpose viewpoint of recreation using criteria, standards, definitions, and projections furnished by the Commission. The National Park Service by agreement developed a plan for each of the major river basins. Cost estimate worksheets were developed based upon Commission standards. A copy of a worksheet is at the end of this Section.

The National Park Service assisted the Commission in estimating use at multiple-purpose projects which were considered in the plan of development. These studies were used in developing a comprehensive plan for the land and water resources. Because the goals remained the same, the impact upon all recreation resources involved continual review. The separable cost remaining benefits system of allocation of costs necessitates estimates for costs and use for likely recreation alternatives to the multiple-purpose projects considered. Alternatives to major projects were suggested by the National Park Service.

The Bureau of Labor Statistics made a study of the workweek anticipated by the year 2000 including projections of holidays and paid vacations. This study is similar to a nationwide study made by the Bureau of Labor Statistics for the Outdoor Recreation Resources Review Commission.

Contracts

The University of Georgia made a special study of the future of outdoor recreation in metropolitan Atlanta in cooperation with the

Outdoor Recreation Resources Review Commission. Atlanta was one of five metropolitan areas in the United States selected for study. Because of the significance of Atlanta in the Southeast River Basins, the Commission participated in sponsoring the study. The report is mainly a critique, no original research having been undertaken. Time and work did not permit a degree of detail for site planning. The study shows population and income characteristics, resources presently available, and the general needs for future outdoor recreation opportunity. Population projections developed by the Commission were used.

The University of Georgia made a study of recreation travel with the Georgia Department of Commerce and the Georgia Highway Department as cosponsors. Data were gathered to show the movement of recreation-seeking people: (1) Who reside in the study area and recreate there, (2) who drive through the study area, (3) who reside inside the area and leave to recreate, and (4) who reside outside and enter the study area to recreate. These data assisted in assessing the current situation and are the basis of estimates used analyzing the mobility factors in refining the goals for 1975 and the year 2000.

Coordination

Because of the many factors dealing with recreation, and the need to define the subject after preparation of the work plan, a Recreation Committee was organized to discuss, review, and recommend actions for the recreation studies. Eleven meetings were held between February 1960 through September 1961. The group participated in discussions and reviewed the scope, definitions, methods, goals, costs, and benefits to be used in the studies. At the later meetings, preliminary plans for the development of recreation for each of the eight river basins were reviewed and discussed.

Recreation plans to meet needs are based upon the adjudged ability to expand existing recreation areas and upon the availability of new areas to satisfy future needs.

Close liaison was maintained with the staff of the National Park Service. The Commission and the National Park Service contacted and consulted the other Federal and State agencies re-

garding future use of areas under their respective administration.

There was continual effort to refine the recreation studies. Outside consultants were called in to assist especially in the matter of estimating tangible benefits for recreation activities. No broad formulas are applied relating use to number of land and water acres required. No special studies have revealed as yet a consistent relationship between population and attendance figures.

Worktables and summary worksheets were developed from which cost information could be extracted and estimated especially in those projects where recreation is one of several purposes. Selection of alternatives to a multiple-purpose project for use in project formulation is necessary. Recreation staff planners from the National Park Service assisted in establishing estimated use for these alternatives, with the limits of projected needs for recreation. Also, it is recognized that if these are reservoir developments there naturally would be outdoor recreation use. Estimates of use were made for those projects in the comprehensive plan of development. No formula is used to arrive at the user-day estimate but rather a judgment estimate was made based upon the experience of recreation planners. Recreations planners from other agencies were consulted to test reasonableness of judgment decisions.

Findings

Each of the major factors — population, in-

come, leisure time, and recreation travel — has a positive effect resulting in increased recreation use projected for the year 2000. Between 1960 and 2000, population is estimated to more than double and to become more urban; nonresidents passing through the basin are expected to increase four times; mobility, mainly travel by automobile, is projected to treble; per capita personal income is expected to double; and leisure time should increase, as holidays go up 75 percent, vacation time doubles, and time at work decreases 20 percent.

Judgment applied to these broad indicators led to the estimate that recreation use in the Southeast River Basins area is expected to increase from some 35 million user-days in the base year of 1960 to 230 million user-days in the year 2000.

Population

The total population by 2000 is projected to be over 10 million people which is more than double the 1960 level. The urban population is projected to increase nearly threefold while that of the rural residents will stay about the same as the 1960 levels. The population projections are covered in more detail in Appendix 9, Economics, Part Three.

Income

The residents of the Southeast River Basins area are expected to increase their average per capita income of \$1,580 in 1960 to about \$2,200 in 1975 and \$3,980 by 2000. Thus, the year 2000

TABLE 2.64
Recreation Projections by Major River Basins
(thousands of user-days)

Basin	Base 1960	Increase 1960-75	User-days 1975	Increase 1975-2000	Total increase	User-days 2000
Savannah	7,230	6,770	14,000	21,000	27,770	35,000
Ogeechee	260	4,080	4,340	5,660	9,740	10,000
Altamaha	3,694	11,596	15,290	20,710	32,306	36,000
Satilla-St. Marys	2,505	6,955	9,460	10,540	17,495	20,000
Suwannee	1,076	5,124	6,200	8,800	13,924	15,000
Ochlockonee	1,050	2,950	4,000	6,000	8,950	10,000
Apalachicola-Chattahoochee-Flint	13,135	12,665	25,800	32,200	44,865	58,000
Choctawhatchee-Perdido	6,050	9,860	15,910	30,090	39,950	46,000
Total	35,000	60,000	95,000	135,000	195,000	230,000

income will be two and one-half times the present per capita income.

Leisure Time

Leisure time available to the people in the study area as in the Nation as a whole is increasing. Length of the work week is decreasing and the average paid vacation is increasing and the average number of holidays is increasing. The number of hours worked each week is expected to decrease by 20 percent by the year 2000 to an average of about 30 hours a week.

Vacation time will more than double between 1960 and 2000 and the number of holidays will increase about 75 percent during the same period. In 1960 for all industries and occupations the average paid vacation in weeks is 1.5. The vacation time by 1975 is estimated at 2.3 weeks and by the year 2000 at 3.2 weeks. The average number of holidays in 1960 is 4.9 days. By 1975 it is estimated at 6.8 and by the year 2000, 8.6 days.

Mobility

From a viewpoint of recreation, basin boundaries and also State and study area boundaries do not confine people. The one main exception to this is hunting and fresh-water fishing where State licenses have some bearing.

The movement of people into and out of the study area for recreation including hunting and fishing in the study area are assumed to be in balance. This assumption was later verified in general by the recreation travel study. On a yearly basis, a survey in 1960-61 shows a net export of about 1 percent; an import balance in summer and fall and an export balance in winter and spring. Nonresidents passing through the study area are treated separately and are significant in number.

Some 10 percent of all vehicular traffic is estimated to include recreation as a purpose. Passenger transportation by automobile is expected to increase about 1.5 times the 1958 totals by 1975 and 3 times the present by 2000.

Inventory of Recreation Areas

Some useful data and information of the significant existing areas were available from each appropriate administering agency. Only those

areas within the Southeast River Basins area itself were included in the final tabulation of existing areas. However, areas within 25 miles of the outside boundary of the study area were considered because of their bearing upon recreation opportunity.

Areas are tabulated under the general heading of "recreation areas." Location by State and river basin, information on visitation, and acreage are the extent of coverage. This information is required in order to tabulate the estimates of visitation in 1959 to the areas in the study area.

Information on visitation to the existing areas gave an approximation of the recreation activity. Only 1959 estimates were used, although information on visitation was received for some of the more established areas for the 5 years preceding 1959.

An inventory worksheet, "Inventory of Recreation Areas," was devised for the purpose of obtaining information and data from all public agencies which administered public outdoor recreation areas. A copy of this worksheet is included at the end of this Section. Data thus obtained were tabulated and a summary of visitation is shown in Table 2.65.

Useful information covering all the significant outdoor recreation areas was very meager. Only the total acreage and visitation of each recreation area was obtained.

In the past, each recreation agency has been responsible for obtaining information on outdoor recreation within its administrative area. The criteria used to obtain this information varied by agency. For purposes of this study, a separate set of definitions were established in order to obtain some uniformity.

An attempt was made to correlate information on use with information on size of areas. However, this approach was abandoned when it was determined that the depth of coverage did not show any relationship between the two.

Methods of making visitation estimates vary by agency; some estimates are the results of accurate counts, others are estimates developed from sample counts, and still others are broad estimates based upon the judgment of some qualified agent. Acreage information in the main is based upon land records.

Information compiled was screened carefully to avoid counting areas more than once. An area

TABLE 2.65
Summary of Public Recreation Visits to Administrative Areas
by Basins in 1959*
(thousands of user-days)

Basin	Federal areas	State areas	County, local, and private	Total
Savannah	3,555.2	188.2	500.0	4,243.4
Ogeechee	8.4	111.0	0.0	119.4
Altamaha	104.5	427.0	550.0	1,081.5
Satilla-St. Marys	120.0	691.9	1,800.0	2,611.9
Suwannee	226.4	429.1	100.0	755.5
Ochlockonee	133.8	134.9	500.0	768.7
Apalachicola-Chattahoochee-Flint	6,276.7	1,113.9	601.7	7,992.3
Choctawhatchee-Perdido	47.0	699.7	1,400.0	2,146.7
Total	10,472.0	3,795.7	5,451.7	19,719.4

* Visitation, including hunting and fishing, was obtained from reports, records, and estimates furnished by cooperating agencies.

leased, for example, by a State park agency from lands owned by the Federal Government is reported by each agency. In tabulating and summarizing the visitation, many areas reported are not incorporated in the recreation plan specifically as they are included as part of a larger area. The inventory of recreation areas in the Southeast River Basins is a rough approximation of the estimated user-days in 1959.

Prospective Demand for Outdoor Recreation

Because of the fact that most recreation information is fragmentary, the inventory of visitation to existing public outdoor recreation areas is one means of establishing a base from which to start the estimates. The recreation projections utilized the information on the existing recreation areas only to the extent of an approximation of user-days.

The inventory accounts for a visitation estimate of 19.5 million visits in 1959 including hunting and fishing. It was judged that this represents only about one-half of the total. In view of this, and conversion of visits to user-days, the estimate for 1960 was made by subtracting 2 million hunting and fishing days and doubling the total, which for planning purposes established a base of 35 million user-days in 1960. This estimate, when placed on a comparable plane with other sections of the country was below the national average, except for hunting and fishing.

It was assumed for the first broad estimate, that there would be about 30 days per resident expressed in some way at some public outdoor recreation area. Using this estimate, it was estimated that the recreation plan should provide for around 300 million user-days of recreation by the year 2000 that some of these user-days would be hunting and fishing user-days and that, as a result of later studies, refinement would modify goals which could be considered more truly representative of the factors used to establish it.

Preliminary projections were made in the spring of 1960 in order to proceed with planning for each major river basin in the Southeast River Basins. Goals were estimated for each of the eight basins in terms of user-days by assuming that future population, available resources, and size of the basin could support goals generally in relation to needs and facilities.

Increments to the nearest 5 percent were used to establish an estimated prospective demand in each basin as shown in Table 2.66.

Refinements were made continually to adjust use to resource availability. The formulation of the recreation plan to meet the prospective demand enabled the planners to develop a rough plan not based upon simple visitation projections, but rather upon an estimated demand for opportunity and the utilization of natural resources which would lend themselves to a well-rounded plan. The 280 million user-days used as a goal were an estimate computed by multi-

TABLE 2.66
Preliminary Estimate of Recreation in the Year 2000

Basin	Projected population		Area		Assigned user-days	
	(1,000)	(percent)	(sq. mile)	(percent)	(1,000)	(percent)
Savannah	1,453	14.5	11,600	11.9	42,000	15
Ogeechee	268	2.7	5,400	6.3	14,000	5
Altamaha	1,785	17.8	14,600	16.7	42,000	15
Satilla-St. Marys	317	3.1	5,500	6.3	25,000	10
Suwannee	408	4.1	10,000	12.6	14,000	5
Ochlockonee	348	3.5	6,300	7.2	14,000	5
A-C-F	3,965	39.2	19,900	22.6	70,000	25
Choctawhatchee-Perdido	1,518	15.1	14,700	16.4	56,000	20
Total	10,052	100.0	88,000	100.0	280,000	100

plying the present estimated use of 35 million by a factor of eight. It actually meant that, although population would double, opportunity including mobility and per capita participation would increase about four times. This total compares with the earlier estimate of 300 million user-days and excludes the activities of hunting and fishing. To establish firm projections from the assumptions made for the preliminary estimates of recreation, additional studies and analysis were undertaken. Special studies were made of leisure time and recreation travel. Also, arrangements were made for examining results of some of the special studies being made on a national basis by the Outdoor Recreation Resources Review Commission.

The advance data on studies of the Outdoor Recreation Resources Review Commission group are of significance to the Southeast River Basins studies. The Bibliography listed later in this Section includes references to the report "Outdoor Recreation for America" and to the Outdoor Recreation Resources Review Commission Study Reports. It was advance information which was used from these Outdoor Recreation Resources Review Commission studies. This data helped in the selection and definition of seven broad activity groups of direct importance to planning procedures. These activities are discussed in the following Section. The California, the Arkansas-White-Red, and the Delaware studies also were referred to and assisted the Commission in developing guidelines.

The special study on recreation travel gives some confirmation of the estimate of 35 million user-days in 1960 based upon the inventory. The

study includes estimates of (1) high value recreation of 25 million user-days; (2) low value recreation, 3 million user-days; and (3) persons passing through the basin of some 40 million. Of the 40 million travel-days, some 12 million spent more than the minimum time of passing directly through the Southeast River Basins area. From studies of the Outdoor Recreation Resources Review Commission, Study #20, on a national basis, it was found that 60 percent of recreation travelers seek recreation facilities enroute to their destination. Accordingly, 60 percent of the 12 million user-days, or some 7 million of the nonresidents passing through the study area in 1960, were estimated to have used existing public outdoor recreation facilities. Thus the independent approach used in the recreation travel studies shows also some 35 million user-days, $25 + 3 + 7$, in the study area in 1960.

The Outdoor Recreation Resources Review Commission studies show that persons in the lower income brackets do not use recreation facilities to the same intensity as persons in the higher income brackets. In the study area, a large number of persons in the low income brackets helps account for the low per capita participation in 1960 compared to other sections of the country. Since income in the study area is expected to increase some two and one-half times by the year 2000, there will be relatively more use of recreation facilities in the future.

The estimates of user-days actually used in the planning for recreation eventually was established at 230 million user-days exclusive of hunting and fishing. Table 2.65 and the narrative at the beginning of the part on Findings summar-

izes the user-days by basin for the key years 1975 and 2000.

First estimates of 300 million user-days and a later estimate of 280 million user-days by the year 2000 were refined after review of the single-purpose recreation plan. The evolution of the 230 million user-days is the result of more cautious thinking about an abrupt increase of some eight times in a 40-year period. Nevertheless, all factors identified as significant pointed to an aggregate increase of large magnitude.

The 230 million user-day estimate of recreation use in the study area by the year 2000 is an expected fivefold plus increase in the period 1960-2000. This estimate compares with a three-fold increase for the United States stated in the Outdoor Recreation Resources Review Commission report and the sevenfold or eightfold increase in the earlier estimates made for the study area.

Selection of Activities

Activities in the recreation studies were selected after thorough consultation with recreation specialists. The State and Federal agencies classify activities according to their particular needs and within the limitations of the laws that established the agencies. Outdoor recreation itself is only partially defined by Public Law 85-570 which established the Outdoor Recreation Resources Review Commission. The Southeast River Basins Commission takes into account the unique feature in its own law which calls for "the development of recreation," and "the enhancement and protection of fish and wildlife." Hunting and fishing have been studied with respect to the fish and wildlife section. All other nonurban outdoor recreation activities are covered under recreation. There is no sharp dividing line between any recreation activity. In many cases the participant pursues more than one activity in 1 day. In order to determine representative costs, groups of activities were selected as a rational method of arriving at the facilities needed. The following list represents the major types of outdoor recreation activities used in the recreation studies.

(1) Sightseeing—Generally those activities related to relaxation and leisure driving such as viewing scenic areas, visiting lookout towers,

structures, and scenic viewpoints were called sightseeing.

(2) Picnicking—Those activities related to picnicking at a specific site, such as wayside areas, State parks, by rivers, lakes, and coast.

(3) Swimming—All water-contact sports which include fresh-water swimming, lakes and rivers, salt-water swimming, surf bathing, and skin and Scuba diving.

(4) Boating—All boating activities such as (a) surf boating, (b) canoeing, (c) row boating, (d) white water canoeing, (e) outboard motorboating, (f) inboard motorboating, (g) sailing, and (h) water skiing.

(5) Camping—Including all types of camping, organized group, individual, family, trailer, tent, and cabin.

(6) Hiking—Includes all walking related sports whose purpose is to get outdoors for out-of-doors activity. Specifically, mountain climbing, trail hiking, horseback riding, wilderness, and beach strolling.

(7) Cultural—Includes the following outdoor recreation activities: (a) Viewing historical sites; (b) viewing archeological sites; (c) viewing geological sites; (d) viewing fish and wildlife; (e) viewing plant life; (f) collecting plants, rock, and related items; (g) bird watching; (h) nature walks; and (i) photography.

(8) Special—Interpretive centers, museums, and similar recreation areas which offer special treatment.

This list defines the eight major activities around which planning was developed. The eighth group was not actually used in practice. Each major activity includes many lesser activities. Table 2.72 summarizes the mix of activities planned for the year 2000. A continuing effort has been made to have a well-rounded recreation program. Overemphasis is avoided on any one type of activity. Both land and water oriented recreation is included and for the latter both large and small water bodies are in the plan.

Recreation Benefits

Recreation benefits consist of the value of any increase in the amount of recreational use expected as a result of the project. Tangible benefits are those expressed in dollars while the intangibles are those incapable of being reduced

readily to dollar values. The intangibles are treated in most cases by descriptive narrative. Benefits to recreation were evaluated by applying a range of derived values to the increase in user-days resulting from the project under expected future conditions with and without the project. Benefits from development or protection of esthetic, scenic, historic, and scientific values are not evaluated in monetary terms but are discussed and described as a basis for qualitative judgment of their importance in project formulation and evaluation. Many studies have been made to try to establish monetary benefits derived from a day of recreation and accrued to the recreationist. Most of the studies have been based upon specific sites and benefits and have been measured after lengthy studies of the costs and monetary benefits to the user. Several significant studies are listed and described in the Bibliography.

Many factors must be considered in establishing primary tangible benefits. The Commission has recognized the lack of any widely accepted dollar evaluation, but has attempted to look at the entity and come up with a judgment estimate which reflects many studies and much discussion. The schedule of dollar value for the activity day of recreation other than hunting and fishing is shown in the following tabulation.

Sightseeing	\$0.50
Cultural activities	0.75
Hiking	1.00
Picnicking	1.00
Swimming	1.00
Camping	2.00
Boating	2.50
Special activities	Assigned values

In application, full consideration should be

given to special aspects of any project or program which are not reflected in monetary evaluations. The monetary benefits should guide rather than control planning decisions.

Generally, four major factors were considered in the schedule for activities.

- (1) Entry or the equivalent to admission to the grounds.
- (2) Equipment or the reasonable cost of equipment required to pursue an activity.
- (3) Facilities or those features needed to permit activity.
- (4) Space or the added area required to pursue activity above the entrance factor.

All activities require entry. Added components of equipment, facilities and space are required. These components and the association with recreation activities used in the study are shown in Table 2.67.

Because each recreationist may participate in more than one activity, benefits can be cumulative for each user-day of recreation. A user who picnics and swims would thus accrue \$2.00 in benefits. It was decided that generally no more than two activities per user-day would be projected. This general rule would keep benefit estimates within reasonable bounds.

Little exists in the way of data and information which would permit more exact and scientifically founded methods of developing these dollar benefits. Further study and research is required in this entire field. Until data and information are improved, reliance on judgment is the primary method in arriving at these benefits.

Single-Purpose Plan

Ways of meeting the recreation needs of the study area from the viewpoint of recreation alone

TABLE 2.67
Components of Benefits to Determine Benefits by Activity
(dollars)

Activity	Entry	Equipment	Facility	Space	Total
Sightseeing	0.50	---	---	---	0.50
Cultural	0.50	0.0625	0.0625	0.125	0.75
Hiking	0.50	0.125	0.125	0.25	1.00
Picnicking	0.50	0.25	0.125	0.125	1.00
Swimming	0.50	0.125	0.25	0.125	1.00
Camping	0.50	0.625	0.625	0.25	2.00
Boating	0.50	1.00	0.50	0.50	2.50

were compiled into a single-purpose plan. This plan was prepared as a reference base to set forth what could possibly be done without considering needs in other functions. With the help of personnel experienced in the recreation field, a combination of recreation developments was compiled. Key considerations were (1) a well-rounded opportunity for variety of recreation experience, (2) dispersion throughout the area but recognizing population concentration, and (3) using natural or cultural resources available in the area.

The single-purpose data also served a useful purpose as a base for selecting likely alternatives

when recreation was later considered for multiple-purpose combinations.

It is possible to meet projected needs either in new development or in expansion of existing developments. The single-purpose plan, however, used a combination of new and expansion of existing which was considered highly desirable by the recreation committee. The single-purpose plan was 57.3 percent new and 42.7 percent expansion of existing developments on the basis of user-day estimates.

Comprehensive Plan

The comprehensive plan includes recreation

TABLE 2.68
Recreation User-Days at Existing and New Areas by Basins*
(thousands)

Basin	Base 1960	1975			2000		
		Existing	New	Total	Existing	New	Total
Savannah	7,230	9,355	4,645	14,000	21,150	13,850	35,000
Ogeechee	260	300	4,040	4,340	590	9,410	10,000
Altamaha	3,694	9,465	5,825	15,290	17,810	18,190	36,000
Satilla-St. Marys	2,505	5,500	3,960	9,460	10,200	9,800	20,000
Suwannee	1,076	1,800	4,400	6,200	5,160	9,840	15,000
Ochlockonee	1,050	1,700	2,300	4,000	4,400	5,600	10,000
Apalachicola-Chattahoochee-Flint	13,135	14,275	11,525	25,800	25,900	32,100	58,000
Choctawhatchee-Perdido	6,050	12,465	3,445	15,910	35,060	10,940	46,000
Total	35,000	54,860	40,140	95,000	120,270	109,730	230,000

* Reference to existing in 1975 and 2000 means expansion of areas existing as of 1960.

TABLE 2.69
Recreation User-Days at Single-Purpose and
Multiple-Purpose Areas—2000 by Basins
(thousands)

Basin	Single purpose	Multiple purpose*	Total
Savannah	16,510	18,490	35,000
Ogeechee	4,640	5,360	10,000
Altamaha	26,380	9,620	36,000
Satilla-St. Marys	16,620	3,380	20,000
Suwannee	9,810	5,190	15,000
Ochlockonee	5,700	4,300	10,000
Apalachicola-Chattahoochee-Flint	41,200	16,800	58,000
Choctawhatchee-Perdido	39,460	6,540	46,000
Total	160,320	69,680	230,000
Percent	69.7	30.3	100

* Recreation areas involved in projects serving purposes other than recreation.

development to meet the estimated 2000 needs of 230 million user-days. Some of these needs would be met on developments existing in 1960—35 million user-days; some on expanded facilities of existing developments—85 million user-days; and some on new developments—110 million user-days. Table 2.68 summarizes by basins the expansion of existing areas and new developments. Special note should be made that the plan includes elements to meet needs projected to 2000 but cost and benefit data are limited to the

increment to be developed during 1960-2000.

Recapitulation of Recreation Data

There are numerous ways of categorizing the recreation part of the comprehensive plan. Recapitulated in Tables 2.69 to 2.72 are several classifications that were found useful in the studies—Table 2.69, multiple purpose-single purpose; Table 2.70, coastal, impoundment, and general land based; Table 2.71, resource classification; and Table 2.72, percent of activities

TABLE 2.70
Distribution of Recreation User-Days by Major Resource Areas by Basins in 2000 (thousands)

Basin	Sea-coast	Major impoundments	General outdoor and cultural	Total
Savannah	4,500	19,260	11,240	35,000
Ogeechee	3,000	3,100	3,900	10,000
Altamaha	—	15,900	20,100	36,000
Satilla-St. Marys	14,550	1,000	4,450	20,000
Suwannee	620	2,710	11,670	15,000
Ochlockonee	3,600	1,440	4,960	10,000
Apalachicola-Chattahoochee-Flint	11,500	29,980	16,520	58,000
Choctawhatchee-Perdido	32,960	1,600	11,440	46,000
Total	70,730	74,990	84,280	230,000
Percent	31	33	36	100

TABLE 2.71
Distribution of Recreation User-Days in 2000 by Broad Resource Classification by Basins (thousands)

Basin	High density	General outdoor	Natural environment	Unique	Primitive	Historic and cultural	Total
Savannah	6,500	11,100	16,515	—	—	885	35,000
Ogeechee	—	3,320	6,100	—	—	580	10,000
Altamaha	21,350	6,590	6,810	—	—	1,250	36,000
Satilla-St. Marys	10,550	3,480	1,150	4,000	—	820	20,000
Suwannee	700	6,540	6,370	—	300	1,090	15,000
Ochlockonee	2,600	4,350	2,050	200	—	800	10,000
Apalachicola-Chattahoochee-Flint	15,950	11,195	27,530	1,600	—	1,725	58,000
Choctawhatchee-Perdido	32,960	7,290	5,150	—	—	600	46,000
Total	90,610	53,865	71,675	5,800	300	7,750	230,000
Percent	39.4	23.4	31.2	2.5	0.1	3.4	100

TABLE 2.72
Distribution of Activities Planned for Period 1960-2000¹

Basin	Increase in user-days (1,000)	Sight-seeing (per.)	Cul-tural (per.)	Picnick-ing (per.)	Swim-ming (per.)	Hik-ing (per.)	Camp-ing (per.)	Boat-ing (per.)	Total (per.)
Savannah	27,770	31	12	33	34	3	11	16	140
Ogeechee	9,740	5	10	50	48	4	9	21	147
Altamaha	32,306	20	7	45	42	3	8	16	141
Satilla-St. Marys	17,495	7	9	38	49	5	11	32	151
Suwannee	13,924	35	13	33	24	1	8	15	129
Ochlockonee	8,950	12	4	49	45	2	8	19	137
A-C-F	44,865	9	9	41	52	2	7	15	135
Choctawhatchee-Perdido	39,950	3	2	30	69	2	5	5	116
Basin averages	195,000	14	8	38	49	2	8	15	134

NOTES: ¹ Recreationists may pursue more than one activity per user-day. Expressed in percentage, these figures contain the estimates of activities by basins. For example, in the Southeast River Basins area, 1.34 activities are estimated for each user-day.

² Negligible quantity.

TABLE 2.73
Summary of Benefits and Costs of Recreation Areas by Purpose and by Basins¹ (thousands of dollars)

Basin	Annual equivalent		Investment cost	
	Benefits	Costs	Early action	Total
Single purpose				
Savannah	7,703.5	1,970.8	10,170.9	32,527.0
Ogeechee	3,406.5	2,272.0	17,146.4	30,696.4
Altamaha	20,650.2	5,595.5	35,364.2	73,963.0
Satilla-St. Marys	16,183.2	3,898.0	31,918.4	58,942.0
Suwannee	4,644.0	1,883.0	12,624.0	23,606.8
Ochlockonee	3,869.2	1,360.8	10,509.3	19,890.0
A-C-F	23,439.0	6,919.4	27,224.1	100,149.0
Choctawhatchee-Perdido	17,608.8	5,880.6	30,309.5	102,715.6
Subtotal	97,504.4	29,780.1	175,266.8	442,489.8
Multiple purpose				
Savannah	22,228.1	6,978.7	42,830.2	107,276.0
Ogeechee	8,779.9	2,341.1	21,809.0	32,101.6
Altamaha	14,002.7	5,627.2	35,360.1	91,625.2
Satilla-St. Marys	5,477.1	1,654.2	13,148.2	21,047.7
Suwannee	7,777.5	3,053.5	22,301.4	44,657.3
Ochlockonee	8,821.7	3,611.0	11,139.8	58,041.2
A-C-F	23,105.3	7,237.3	68,470.0	110,786.0
Choctawhatchee-Perdido	10,225.6	3,015.8	23,238.6	39,154.6
Subtotal	100,417.9	33,518.8	238,297.3	504,689.6
Total	197,922.3	63,298.9	413,564.1	947,179.4

NOTES: ¹ Costs include those specific costs derived from recreation facilities and allocated costs to recreation derived from multiple-purpose projects. Benefits and costs cover increment of plan to be developed in period 1960-2000.

² Gulf Coast Improvement project accounted for in Ochlockonee basin.

³ Highlands project accounted for in Savannah basin.

planned by 2000. In addition the costs and benefits can be summarized in several ways. Table 2.73 shows benefit and cost data by multiple pur-

pose and single purpose; Table 2.74, by new and expansion of existing; Table 2.75, by States; and Table 2.76, by basins.

TABLE 2.74
**Summary of Benefits and Costs of Recreation Areas
 by Existing and New Development¹**
 (thousands of dollars)

Basin	Annual equivalent		Investment cost	
	Benefits	Costs	Early action	Total
Existing areas				
Savannah	12,229.9	4,341.8	23,570.0	74,970.9
Ogeechee	230.9	63.4	245.0	990.4
Altamaha	11,334.6	2,850.5	19,646.7	42,077.0
Satilla-St. Marys	7,894.6	1,568.4	10,158.4	27,089.0
Suwannee	2,504.3	785.2	5,031.2	13,540.8
Ochlockonee	2,393.1	753.5	4,685.3	13,198.0
Apalachicola-				
Chattahoochee-Flint ²	11,018.4	2,834.3	8,306.1	48,149.0
Choctawhatchee-Perdido	14,664.0	4,711.2	25,715.5	85,713.5
Subtotal	62,269.8	17,908.3	97,358.2	305,728.6
New areas				
Savannah	17,701.7	4,607.7	29,431.1	64,832.1
Ogeechee	11,955.5	4,549.7	38,710.4	61,807.6
Altamaha	23,318.3	8,372.2	51,077.6	123,511.2
Satilla-St. Marys	13,765.7	3,983.8	34,908.0	52,900.7
Suwannee ³	9,917.2	4,151.3	29,894.2	54,723.3
Ochlockonee	10,297.8	4,218.3	16,963.8	64,733.2
Apalachicola-				
Chattahoochee-Flint	35,525.9	11,322.4	87,388.0	162,786.0
Choctawhatchee-Perdido	13,170.4	4,185.2	27,832.6	56,156.0
Subtotal	135,652.5	45,390.6	316,205.7	641,450.5
Total	197,922.3	63,298.9	413,563.9	947,179.1

NOTES: ¹ Costs include those specific costs derived from recreation facilities and allocated costs to recreation derived from multiple-purpose projects. Benefits and costs cover increment of plan to be developed in 1960-2000.

² Highlands project accounted for in Savannah basin.

³ Gulf Coast Improvement project accounted for in Ochlockonee basin.

TABLE 2.75
Summary of Benefits and Costs of Recreation Areas by States*
 (thousands of dollars)

State	Annual equivalent		Investment cost	
	Benefits	Costs		Total
North Carolina	6,549.3	3,107.5		51,554.4
South Carolina	25,280.3	7,468.5		113,131.8
Georgia	132,972.8	41,718.0		627,569.3
Florida	57,379.5	18,891.3		281,498.2
Alabama	16,494.9	4,876.3		71,001.8

* Nonadditive—entire costs of border projects included in figures for States concerned. Benefits and costs cover increment of plan to be developed in period 1960-2000.

TABLE 2.76
Summary of Benefits and Costs of Recreation Areas by Basins
(thousands of dollars)

Basin	Annual equivalent		Investment costs Total
	Benefits	Costs	
Savannah	29,931.6	8,949.5	139,803.0
Ogeechee	12,186.4	4,613.1	62,798.0
Altamaha	34,652.9	11,222.7	165,588.2
Satilla-St. Marys	21,660.3	5,552.2	79,989.7
Suwannee ²	12,421.5	4,936.5	68,264.1
Ochlockonee	12,690.9	4,971.8	77,931.2
A-C-F ³	46,544.3	14,156.7	210,935.0
Choctawhatchee-Perdido	27,834.4	8,896.4	141,870.2
Total	197,922.3	63,298.9	947,179.4

NOTES: ¹ Costs include those specific costs derived from recreation facilities and allocated costs to recreation derived from multiple-purpose projects. Benefits and costs cover increment of plan to be developed in 1960-2000.

² Gulf Coast Improvement project accounted for in Ochlockonee basin.

³ Highlands project accounted for in Savannah basin.

Impacts of Nonrecreation Projects on Outdoor Recreation Opportunity

Visitation data show a rapid increase at areas designed primarily for other project purposes. Large impoundments constructed for flood control, navigation, and power, and forests improved for watershed protection, timber management, and fire control have become sources for outdoor recreation opportunity. In the main, recreation has not been treated as a major project purpose, yet participants have enjoyed the benefits as an incidental byproduct.

Recreation needs can be met by installation of new facilities, expansion of existing facilities, or a combination. With the expansion of existing facilities, no new development of recreation is absolutely necessary until after 1980. However, many new recreation resources become available by the addition of projects to meet needs other than recreation. Participation in the costs in the development of these projects reflects the fair share of benefits obtained.

Impacts of Other Purposes on Recreation

Forestry, fish and wildlife, soil conservation, flood control, and hydroelectric power impoundments are some of the resource purposes which have impacts on recreation.

All water-oriented phases of recreation require suitable surface water quality. Many of these activities contribute to water pollution, particularly in the popular designated public areas

of impoundments. Adequate safe water supplies and waste disposal facilities are included in the planning of recreational use of surface waters. Some existing developments have created water quality problems that must be solved for continued or expanded use.

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

National Park Service, Region One, Richmond, Virginia: *Unusual Area Study*, 1960.

A brief inventory with narrative describing areas of (1) historic, (2) natural and (3) archeological significance in the Southeast River Basins. These areas and sites were not operated, developed, administered, or accessible at the time of the study for use as public outdoor recreation opportunity.

Single Purpose Recreation Plan for the Southeast River Basins, 1961.

The basic source from which the Commission molded its own recreation plan.

Terminal Studies for the Recreation Plan, May 1, 1962.

Presented impact studies on multiple-purpose areas and the recreation use as a result of comprehensive resource planning in the Southeast River Basins.

Special Studies, Alternatives to Multiple-Purpose Storage Projects used in Evaluation of Recreation Participation in the Southeast River Basins, May 1962.

U. S. Department of Labor, Bureau of Labor Statistics. *Estimates of the Decrease in Hours Worked in the Southeast River Basins Areas 1960-2000*, July 1961.

Used to assist the Commission staff in defining the impacts of a shorter work week and longer vacations, which in turn would assist the staff in establishing the goals to be used in recreation planning.

University of Georgia, Bureau of Business Research. *Tourism and Recreation Travel in the Southeast River Basins Study Area*, Athens, Georgia, October 1961.

An original study carried out jointly for the Georgia Department of Commerce, Tourist Division, the U. S. Study Commission, and the Georgia Highway Department. The study supplied the Study Commission with valuable information which permitted the use of assumptions in developing future recreation needs.

University of Georgia, Center for Continuing Education. *The Future of Outdoor Recreation in the Atlanta Standard Metropolitan Statistical Area*, Athens, Georgia, September 1961.

A study made jointly by the U. S. Study Commission and the Outdoor Recreation Resources Review Commission. Although no original research was carried out the study emphasized the complex problems which will develop for the creation needs and opportunities of the residents of the area.

Other references used:

Audience Research, Inc. *Outdoor Recreation Activities and Preferences of the Population Living in the Region of the Delaware River Basins*, Princeton, New Jersey, January 1958.

Report, prepared for the National Park Service, assisted the Commission in selecting activities and the extent of participation.

Beazley, Ronald I. *Some Consideration in Optimizing Public Forest Recreational Development and Value*, Journal of Forestry, September 1961, Vol. 59, No. 9.

Brockman, C. Fraud. *Recreation Use in Wild Lands*, New York, N. Y., 1959.

California Public Outdoor Recreation Plan Committee. *California Public Outdoor Recreation Plan, Part I and Part II*, Sacramento, California, 1960.

This report assisted the Commission staff to establish the degree of detail in order to develop a plan. Guidelines and criteria were used where adaptable to river basin planning.

Clawson, Marion E.:

The Dynamics of Park Demand, Regional Plan Association, Inc., New York, N. Y., 1960.

The Crisis in Outdoor Recreation, Resources for the Future, Inc., Washington, D. C., 1959.

Methods of Measuring the Demand for and Value of Outdoor Recreation, Resources for the Future, Inc., Washington, D. C., 1959, Reprint No. 10.

Statistics on Outdoor Recreation, Resources for the Future, Washington, D. C., 1958.

Inter-Agency Committee on Water Resources. *Report of the Panel on Recreational Values on a Proposed Interim Schedule of Values for Recreational Aspects of Fish and Wildlife*, E. H. Wiecking, Chairman, Subcommittee on Evaluation Standards, Washington, D. C., May 1960.

National Park Service. *State Park Statistics*, Washington, D. C.

Annual publication supplied the Commission staff with general cost information which served as an independent check as to the reasonableness of facility costs and use.

National Recreation School. *Extra Urban Recreation Activities Enjoyed and Desired by Families in Amarillo*

and Texarkana, Texas, and Tulsa, Oklahoma, New York, N. Y., 1953.

Report, prepared for the National Park Service, was used by the Commission staff in developing demand for outdoor recreation goals.

Outdoor Recreation Resources Review Commission:

Outdoor Recreation for America, Washington, D. C., 1962.

The report was available to the U. S. Study Commission, Southeast River Basins too late to coordinate findings and use them for recreation planning, but the findings were useful checks for reasonableness in defining the magnitude of outdoor recreation.

ORRRC Study Reports, Washington, D. C., 1962.

Several of the special study reports were released in time for the Study Commission to test assumptions for reasonableness. ORRRC Special Study Report No. 20 by Eva Mueller and Gerald Gurin, with the assistance of Margaret Wood, enabled the Commission to develop an activity schedule which was adaptable to basin planning. Special Study No. 26 enabled the Commission to confirm the prospective demand used in planning for future needs.

Trice, Andrew H. and Wood, Samuel E. *Measurement of Recreation Benefits*, Journal of Land Economics, Vol. 34, No. 3, August 1958.

U. S. Army, Corps of Engineers. *Delaware Basin Report*, Philadelphia, Pennsylvania, 1960.

Many standards, definitions, guidelines, and criteria assisted the staff and were applicable to developing the Recreation Plan.

U. S. Department of Agriculture, Forest Service. *Work Plan for the National Forest Recreation Survey*, Washington, D. C., 1959.

The outline, definitions, and standards contributed to develop the Commission work plan and to define the degree of detail to be pursued in the Recreation Studies.

Wood, Donald F. *The Distances-Traveled Technique of Measuring Value of Recreation Areas: An Application*, Land Economics, November 1961, Vol. 37, No. 4.

Supplemental Data

Selected documents concerning outdoor recreation in the Southeast River Basins follow. These documents are referred to in the earlier portions of this Section. Only those documents having special use by the reader of this Appendix are included. All other pertinent data on recreation are contained in the files of the U. S. Study Commission, Southeast River Basins.

Material that follows includes:

Work Plan—Recreation

Definitions

Inventory Questionnaire

Work Sheets.

WORK PLAN — RECREATION

(edited to delete administrative details)

I. General

Public Law 85-850 includes a requirement that (1) an investigation, study and survey be made and (2) a com-

prehensive and coordinated plan be prepared for the development of recreation. It is anticipated that the overall plan to be developed by the U. S. Study Commission will cover all aspects of recreation. The urban, indoor and outdoor, type of recreation will be covered in qualitative general terms and the main attention will be focused upon non-urban, outdoor, land and water resource based recreation. Recreational developments will be included to the degree that they are justified or are expected to become justified at the end of any given time interval. Some of the recreation functions will be best accomplished by single-purpose developments but some will be a part of a multiple-purpose plan.

II. Purpose

The purpose of the recreation investigation is to insure that all phases of recreation are considered in developing a comprehensive plan to meet anticipated requirements of the increased population for the years 1975 and 2000. The plan will include recommendations that will allow for orderly and timely development of recreational resources.

III. Scope and Detail

The term recreation is used in the broad sense to apply to areas of scenic, scientific, and historical interest as well as to apply to active recreation. The inventory of the recreational resources and the present developments as well as recreational programs now underway will be carried to the degree of detail that is prevalent and standard in the State and Federal organizations that work in the recreational field. Estimates of future needs for recreational development will be based upon the present and projected population, leisure time, mobility, and income in the Southeast River Basins area. The needs of the people for recreational resources will include tourism which involves the Southeast area because people are traveling from the population centers to the North and West through the Southeast River Basins area to the attractions of the South Atlantic and the Gulf Coastal areas as well as the mountain areas, the Blue Ridge. The recommendations and reporting on recreation will be on a scale and level that will enable broad planning. Cost estimates of development and the provision of recreational facilities would be at the reconnaissance level. In the main where recreational facilities are included as part of a multiple-purpose project, the cost estimates would be carried to the same degree of detail as those of the other functions being served by the multiple-purpose project. This could well be to the so-called degree of survey of feasibility estimates. An analysis of the benefits; including indirect will be made. For those direct benefits a term of expression or evaluation that is coordinated with the other functional studies will be used.

IV. Guidelines

The study will cover all aspects of recreation in a general way. In some instances, areas will be pinpointed where it is felt those particular areas are unique. The study will obtain data and inventory preferably by agreements. Contracts will be negotiated where more comprehensive work is required. Population and economic projections as worked up by the Commission will be used.

V. Work Plan Outline

- A. Definitions and planning criteria
- B. Technical Tasks
 - 1. Inventory—Ownership and/or management
 - a. Location of recreational areas and facilities (including maps, to show locations of major areas as a minimum)
 - 1. Within the Southeastern River Basins area of study
 - a. by States
 - b. by physiographic areas by river basins
 - c. by other areas as may be determined to be needed during the course of the study
 - 2. Outside the SERB study area but adjacent to it and of sufficient significance in supplying recreational facilities to people within the area to warrant consideration
 - b. Amount of recreational areas (acreage and capacity of areas and facilities by type, i.e., water, forest, beach, park, swamp, etc.)
 - 1. by states, counties and physiographic areas
 - 2. by physiographic areas by river basins
 - 3. by other areas as needed
 - c. Classification of recreational facilities—uses by types
 - 1. Primary uses—i.e., hunting, fishing, swimming, hiking, etc.
 - 2. Secondary uses
 - d. Quality of recreational areas and facilities
 - 1. As measured by accessibility
 - 2. As measured by attendance
 - 3. As measured by participation in their potential uses
 - 2. Adequacy of Existing programs
 - a. Existing recreational programs—organized programs
 - 1. Public programs (Federal, State, urban, etc.)
 - a. Legislatively authorized programs and those which are tax supported (publicly financed)
 - b. Other
 - 2. Private group programs
 - b. Trends in recreational programs and the adequacy of present programs in meeting current needs
 - 1. Trends by type of program and by physiographic areas by river basins
 - 2. Adequacy by areas served
 - 3. Estimation of Future Needs in 1975-2000
 - a. Analysis of population factors influencing needs (including national and regional trend studies in relation to SERB and trend studies by physiographic areas by river basins)
 - 1. Numbers, composition, and distribution
 - 2. Characteristics
 - a. urban and rural
 - b. age groups
 - c. occupations
 - d. employment and leisure time

- 3. Recreational interests
 - a. participation
 - b. use
 - c. location of facilities used
- b. Analysis of *physical* factors influencing needs (including trend studies by physiographic area by river basins)
 - 1. Appraisal of existing areas
 - a. For current actual usage
 - b. For potential usage—capacity usage
 - 2. Appraisal of additional areas which indicate a potential usage for recreational purpose
 - a. As conventional facilities
 - b. As cultural facilities (scenic, biotic, historic, geologic, etc.)
- c. Analysis of *economic* factors influencing needs (including national and regional trend studies in relation to the SERB area and trend studies by physiographic areas by river basins)
 - 1. Recreational service to people
 - a. people living in the SERB area
 - b. people living outside the SERB area (tourists and visitors)
 - 2. Competition for use of resources (recreation versus other uses)
 - d. Evaluation of costs and benefits—Studies to be made on evaluation of recreation
 - 1. Tangibles or direct cost and benefits
 - 2. Intangibles or indirect cost and benefits
 - e. Development of programs to meet needs
 - 1. Determine land and water resources required
 - a. Type
 - b. Value
 - c. Quality
 - d. Quantity
 - 2. "Ideal" plan for recreation
 - a. Primary use program—based upon types
 - b. Multipurpose use of recreation types
 - c. Maximum recreational needs
 - d. Factors in implementing programs
 - 1. Cost
 - 2. Legislation
 - 3. Participation—Federal, State, local and private
 - 4. Management of program
 - e. Planning coordination with responsible agencies
 - 1. Park
 - 2. Highway
 - 3. Local organization
 - f. Relation of recreational resources to other functions
 - 1. Flood control
 - 2. Water supplies
 - 3. Navigation and other transportation
 - 4. Reclamation and irrigation
 - 5. Hydroelectric and industrial development
 - 6. Agriculture and soil conservation
 - 7. Forestry
 - 8. Fish and wildlife
 - 9. Sediment control
 - 10. Pollution abatement—public health—education
(This section should go into conflict of interests and multipurpose uses)
- g. Analysis of alternative programs and plans to meet needs
 - 1. Physical plans
 - a. Plans which will meet maximum-minimum needs
 - b. Modified plans to take competitiveness and complimentarity in the use of resources for other purposes into consideration
 - 2. Public agency (Federal and non-Federal) and private organization programs needed
 - 1. Programs to meet maximum-minimum needs
 - 2. Modified programs which may be needed when competitiveness and complimentarity of resource use have been taken into account
 - h. Formulation of a comprehensive recreation program which may be expected to fit best into the comprehensive plan for land and water resource development (by physiographic areas by river basins and for the entire SERB area) and considerations involved in the implementation of the plan
 - 1. Analysis of all programs and plans studied for the purpose of reaching a decision as to a best combination of programs and plans to be recommended (at this point in the analysis all pertinent economic, social, physical, political, and legal factors should be taken into account)
 - a. Publicly owned and/or managed land and water areas
 - b. Privately owned and/or managed land and water areas
 - 2. Analysis of factors involved in implementation of the plan selected to meet objectives
 - a. Educational factors and considerations
 - b. Legislative factors and considerations
 - 1. direct
 - a. acquisition (fee simple or other)
 - b. leasing
 - c. zoning
 - 2. indirect
 - a. taxing
 - b. supplying incentive through

- various other means (such as direct or indirect payments)
- 3. Summary of results and conclusions preparatory to fitting recreational needs narrative and illustrative materials into the comprehensive report and appendices
- i. Preparation of recreational sections of the comprehensive report and appendices to meet current and future needs
 - 1. Preservation and improvement of existing facilities
 - 2. Addition of new facilities
 - 3. Development of highest economic potential
 - 4. Cultural features
 - 5. Provision for periodic review and revision
 - 6. Other

**C. Technical programming
(Administrative details)**

VI. Costs and Benefits

Definitions and standards used in computing recreation costs and benefits are as follows:

Recreation—The refreshment of body and mind that a person derives from an activity other than work and normal daily routine. For the Commission study, emphasis will be placed on the utilization of land and water outdoor resources.

Recreation demand—The total pressure on recreation resources normally expressed in user-days.

Recreation preference—The activity that an individual would prefer if all opportunities for recreation were available.

Recreation supply—Those resources which are or will become available to fulfill the recreation demands of persons who wish to pursue recreation activities (measured in user-days).

User-day—A unit of measurement indicating a visit to a particular area by an individual on any one day.

Visitor—That individual who uses a recreation area.

Short visit—Any day-use visit of a recreation resource not extending overnight.

Long visit—Any use of a recreation resource extending overnight including weekends or vacations.

Recreation area—A land or water area having natural or developed sites valuable for recreation.

Developed area—That part of an existing recreation area having facilities furnished for intensive use.

Undeveloped area—Any part of a recreation area set aside exclusively for recreation use in which no facilities exist or the dispersed or remaining part of a recreation area where activity is dispersed over a large acreage.

Unusual area—A tract of land which is of archeological, historic, or other significant interest.

Land area—A tract of land, measured in acres and (under one management) which is used for recreation.

Water area—A tract of water, measured in surface acres which is used for recreation.

Federal area—Those tracts of land administered by Federal agencies which are or may be used for recreational activities.

State area—Those tracts of land administered by State agencies which are or may be used for recreational activities.

Local agency area—Those tracts of land administered by municipal, local, or county agencies which are or may be used for recreational activities.

Private recreation area for public use—Those areas owned and managed by private interests for public recreational use without membership requirements.

Study area—The Southeast River Basins that includes Basin I—the Savannah; Basin II—the Ogeechee; Basin III—the Altamaha; Basin IV—the Satilla—St. Marys—Nassau; Basin V—the Suwannee; Basin VI—Coastal rivers between the Suwannee and the Apalachicola; Basin VII—the Apalachicola; Basin VIII—Coastal rivers between the Apalachicola and the Alabama.

River basin—One of the eight major river basin units within the study area.

An activity day is a measurement indicating the participation by one individual in one activity in one day in any one area.

Daily capacity describes the number of activity days of a particular recreation area on an average busy summer Sunday. For U. S. Study Commission planning purposes, this number has been determined to be 2% of the annual activity days.

Design capacity — number of persons using recreation facilities at any one time and around which facility planning is made. This capacity is determined by dividing the turnover factor into the daily capacity.

Turnover — rate of change per day of the daily capacity. For planning purposes, these factors have been determined to be as follows:

1. Sightseeing—ten times per day
2. Picnicking—two and a half times per day
3. Cultural—four times per day
4. Swimming—One and two-thirds times per day
5. Hiking—four times per day
6. Camping—once per day
7. Boating—three times per day
8. Special—to be determined by the special activity use.

Work Sheet - Inventory of Recreation Areas

1. State _____ undeveloped sites do not necessarily equal total visitation at area.

2. River Basin _____ 8. Total estimated capacity _____ user-days

3. Name of Area _____ 9. Total estimated capacity for developed sites _____ user-days

4. Agency _____ 10. Total estimated capacity for undeveloped areas _____ user-days

5. Acreage
 (a) Total land and water area in acres _____
 (b) Total land area in acres _____
 (c) Total water area in surface acres _____
 (d) Total acreage of developed sites _____
 (e) Total acreage of undeveloped area _____

6. List names of developed sites within the area and give acreage of each site.
 Total developed sites in acres _____

7. List total monthly visitation for area in 1959 or latest available year in user-days for developed sites and undeveloped sites. Totals for developed sites and

11. List visitation for total recreation area by months and years for 1955-59.

12. Percent of total visitors traveling specified distances
 (a) Less than 25 miles _____ %
 (b) Between 25 and 50 miles _____ %
 (c) Over 50 miles _____ %
 (d) Out of State _____ %

13. Total short visits _____ 15. Is hunting permitted? _____
 14. Total long visits _____ 16. Fishing? _____
 17. Number of man-days hunting _____
 18. Number of man-days fishing _____

Worksheet — For Single Recreation Activity Facility Costs and Benefits

Name of Area		Basin		Total Annual User-Days (TAUD)					
Activity	Participation by activities ¹ (percent)	Annual activity days (A x TAUD) (number)	Design capacity factor ² (percent)	Design capacity (B x C) (number)	Activity costs for facilities per person capacity ³ (dollars)	Total facility costs for single activities (E x D) (dollars)	Annual O&M cost by activity ⁴ (dollars)	H Unit values by activity ⁵ (dollars)	I Total benefits by activity ⁶ (B x H) (dollars)
Sightseeing		0.2		2.00			0.50		
Cultural		0.5		5.00			0.75		
Picnicking		0.8		40.00			1.00		
Swimming		1.2		20.00			1.00		
Hiking		0.5		100.00			1.00		
Camping ⁷		2.0		100.00 ^a 150.00 ^b			2.00		
Boating ⁷		0.7		20.00 ^c 62.50 ^d			2.50		
Special									
Total		xx		xx			xx		

¹ Estimated.

² See Definitions and Standards for Recreation Facility Cost Analysis, March 8, 1961.

³ Cost Criteria for Recreation, dated March 8, 1961, Revised April 4, 1961.

⁴ User-days O&M costs are determined by dividing the Total Annual User-days by the Total Annual Activity Days times \$10 the Activity Days in the appropriate activity.

⁵ See Tentative Dollar Value for User-day of Recreation, dated January 18, 1961.

⁶ Camping: • Individual Campers (\$100 per person with each site on basis of serving 5 individuals)

⁷ Boating: • Group Campers (\$150 per person with each site on basis of serving 200 campers)

• Boating Ramp and Ramp Docks

• Docks and Small Boat Piers.

Worksheet - To Determine Average Annual Cost, Benefits, and Operations, Maintenance and Replacement for Recreation Facilities

Name Basin	Initial const. (A) to 1975	Deferred Const. (B) to 2000	Total Const. (C)
TOTAL ANNUAL USER-DAYS:			
1. Total construction cost	\$	\$	\$
2. Interest during construction	\$	\$	\$
3. Total investment cost %	%	\$	\$
ANNUAL COST OF INITIAL CONSTRUCTION: (Items 4 + 6)			
4. Ann. Amort. (.0.....) of item 3A			\$
5. O, M & R:			
a. 3% of 3A		\$	
b. User-day O & M (10¢/user)	\$		
c. Annuity factor (.....yr.)	(.....)		
d. Average O & M (bxc)		\$	
e. Replacement (.....% of 1A)		\$	
6. Ann. Average O, M & R		\$	\$
ANNUAL COST OF DEFERRED CONSTRUCTION: (Items 10 + 12)			
7. Year to deferred construction			
8. Years of deferred construction			
9. Annuity factor	(.....)		
10. Average Ann. Const. Cost (3B×9)			\$
11. O, M & R:			
a. 3% of 3B	\$		
b. User-day O & M (10¢/user)	\$		
c. Annuity factor	(.....)		
d. Average O & M (a + b) + c		\$	
e. Replacement (.....% of 1B)		\$	
12. Annual Average O, M & R		\$	\$
TOTAL ANNUAL COST			
TOTAL OPERATIONS, MAINTENANCE, AND REPLACEMENT: (ANNUAL)			
ANNUAL BENEFITS OF INITIAL CONSTRUCTION: (Benefits \$			
13. Benefits, Init. Construction %		Column I, Tab. pg. 2-143)	
14. Years to reach benefits		\$	
15. Benefit adjustment factor		YRS.	
16. Average ann. benefit (13×15)		(.....)	\$
ANNUAL BENEFITS OF DEFERRED CONSTRUCTION:			
17. Benefits, Deferred Construction %		\$	
18. Years deferred after initial construction		YRS.	
19. Years required to reach benefit level		YRS.	
20. Benefit adjustment factor		(.....)	\$
21. Average annual benefits (17×20)			\$
TOTAL AVERAGE ANNUAL BENEFITS (items 16 + 21)			
Operation, Maintenance and Repair @ 1975		¹ @ 2000	²
Annual Amortization (Items No. 5)		(5 + 10)	
Costs per capita:			
Investment	\$		
OM&R			
Annual Amort.			
Benefits			

¹ Derived from Items 5a + 5b + 5e

² Derived from Items 2 + 3, Tab. pg. 2-145

Worksheet – For Summary of Recreation Costs and Benefits

Name of Area Design Capacity Column D, Tab. pg. 2-143

Basin

Construction Costs:

1. Total Facility Costs for Single Activities
(Column F, Tab. pg. 2-143) \$

2. Common Facility Costs:

a. Parking—\$50.00 per person capacity \$

b. Water Supply—\$25.00 per person capacity \$

c. Sanitary—\$50.00 per person capacity \$

d. Roads: (1) Class E, miles @ \$44,400 per mile \$

(2) Class G, miles @ \$19,600 per mile \$

e. Admin. Area \$.05 times Total Activity Days — Column B, Tab. pg. 2-143 \$

Subtotal \$

3. Construction of Special Feature \$

4. Special Access Feature miles \$

5. Real Estate: acres @ \$ per acre \$

Subtotal A \$

Contingencies: 15% of Subtotal A \$

Subtotal B \$

Engineering and Design, 10% of Subtotal B \$

Supervision, Inspection, and Administration, 8% of Subtotal B \$

Subtotal C \$

Interest During Construction¹ % of Subtotal C for years \$

Total Construction Cost: \$

Total Annual Costs:

1. Annual Amortization @² % (.0) of Total Construction Costs \$

2. Operation and Maintenance:

a. 3% of Subtotal C above \$

b. User-day O&M—Total Column G, Tab. pg. 2-143 \$

Subtotal O&M \$

3. Replacement³ % of Subtotal C above \$

Total Annual Cost: \$

Annual Net Benefits—Column I, Tab. pg. 2-143 \$

¹ 2½% for Federal projects, 4⅓% minimum for others. Percentage should be applied to half of the construction period indicated.

² 25/6% (0.03614) for Federal projects, 50 year useful life. * (OM&R \$) 4⅓% minimum (0.04856) for others, 50 year useful life.

³ 0.945% for Federal projects; 0.858% for others.

SECTION XIV – SALINITY AND SEDIMENT CONTROL

General Concept

For the purpose of this study, salinity control is defined as remedial or prevention measures, including land and water utilization, necessary to prevent or reduce: (1) Degradation of surface and ground waters by naturally occurring saline substances, and (2) improvement of saline soils if alternative uses of such soils are needed and feasible.

Sediment is considered as the product of the erosive action of water on soil and its parent materials and consists of organic and inorganic undissolved solids. Sediment may be transported as suspended load and bedload in flowing water or in minor quantities by wind and other agents of erosion. Sediment control is accomplished by those practices or measures which reduce the movement of soil particles.

Some definitions of other significant salinity and sediment control terms are:

Bedload consists mostly of larger particles that are moved by sliding, rolling, or skipping along the streambed.

Channel erosion is scour by concentrated flow. Factors influencing rate of channel erosion are the stream gradient, size and nature of bed and bank materials, hydraulic characteristics of the flow, and the amount of sediment in transport.

Delivery rate is the ratio of sediment yield to gross erosion.

Sedimentation is the product of erosion, transportation, and deposition of sediment in water.

Sediment yield is the total sediment outflow from a watershed. It includes both bed materials and suspended materials.

Suspended load consists of the smaller sediment particles that are in continuous suspension due to stream turbulence.

Suspended sediment index station is one that is operated in such a manner that daily, monthly and annual sediment discharge can be computed. The terms "daily" or "comprehensive" are commonly applied to such stations.

Sediment accumulation in a reservoir depends upon reservoir shape, ratio of reservoir capacity to drainage area, water retention time, and variation in water level. These influences and the load and sediment particle size are considered in predicting the rate of sediment accumulation in proposed reservoirs.

Saline soil is nonalkali soil that contains sufficient soluble salts to impair its productivity.

Salinity is the relative concentration of salts, usually sodium chloride in a given water. It is usually expressed in terms of the number of parts per million of chloride ions. All salts in solution change the physical and chemical nature of water and exert osmotic pressure and some have physical or toxic effects as well.

Primary purposes of the salinity and sediment control studies were to examine sediment conditions, yield, and sources; determine the existence, extent, and pattern of present salinity, sediment damages and problems; and determine the adequacy of existing facilities and programs of salinity and sediment control. The studies were designed to determine future salinity and sediment control needs and to furnish plans for improving land and water quality. An objective in

the sediment control studies was to determine if land treatment and structural programs for improving farmland, pastureland, rangeland, forestland, and for waterflow retardation are effective measures for sediment control.

Work Plan

A work plan was developed by an analysis of essential data. The initial work to determine the scope of the studies involved making an evaluation of the quality, quantity, and usability of the limited amount of basic data available on salinity and sediment control. Some data were in Federal agency files but readily available data were limited. A result of this evaluation was the determining of the gaps in basic data. Consideration was given to ways and means of filling the gaps in basic data. It was apparent that certain Federal agencies most actively engaged in various assistance programs involving salinity and sediment control were best equipped to perform designated studies and furnish results.

Salinity control and sediment control work plans were prepared setting forth the requirements of studies. These are included at the end of this Section. Subsequently, a committee of Federal and State agencies specialists having an interest in and technical knowledge of salinity submitted their review comments on the contents of the work plans. The committee was concerned primarily with the identification of basic data required and with review of proposals for work assignments to be performed for the Commission by designated agencies. The committee served strictly in an advisory capacity.

The work plans originally included general statements, definitions, purpose and objectives of the proposed studies, established guidelines, and contained work outlines of items of study to be performed for salinity control and sediment control. Although the work plans for the water phase of salinity control were originally in great detail, it was subsequently decided that only an analysis of water quality data, including salinity, would be made. Also, that the soils phase of the salinity control studies would consist only of an inventory of the magnitude of saline soils and uses being made of these areas.

An agreement entered into with the U. S. Department of Agriculture, Soil Conservation

Service, provided for the furnishing of technical data and doing of field work for the soils phase of salinity control and for sediment control.

The U. S. Department of Interior, Geological Survey, prepared a digest of information on salt-water encroachment along the Atlantic and Gulf coasts and sediment yield measurements made on the major streams in the study area. These data were useful in determining the location and magnitude of saline influences on water supplies and in estimating the quantitative measurements of sediment contained in streams.

Work Performance

Salinity and sediment control work plans were furnished to the cooperating agencies, indicating the study items and information to be covered in preparation of technical memoranda for each of the eight basin study areas. Study items were set forth principally in outline form as specific questions or paragraphs covering items for which data were to be prepared.

To supplement available information, data sheets were prepared on the soils phase of salinity control and sent to each Soil Conservation Service work unit office in coastal counties in the study area. The information supplied from the field was compiled by basin areas. Data on salinity control were limited and information on soils phase of salinity control is contained in soil conservation and utilization data.

Results and findings of the study items made by the Soil Conservation Service were consolidated into technical memoranda for sediment control for the eight basins. Each technical memorandum consists of narrative discussions with supporting tables. Where applicable or appropriate, a brief explanation of procedure used for specific items was included in each memorandum.

The technical memoranda prepared by Soil Conservation Service were correlated and approved by the U. S. Department of Agriculture, Southeast Field Advisory Committee. This Committee designated by the Secretary of Agriculture, included as Chairman, the Commission member representing the Department of Agriculture who also represented the Soil Conservation Service; along with designated representatives from the U. S. Forest Service and the Economic Research Service.

Coordination

As required, informal meetings and discussions between agency representatives were held as necessary for the exchange of information and data. Agency work assignments were accomplished under the review of the Commission.

In addition, the Land, Water, and Economics Groups composed of experienced planners reviewed preliminary basin reports, including information on salinity and sediment control. As an incidental associated activity, these groups served as a medium for disseminating study results to the Federal and State agencies primarily concerned with land and water resources development.

Findings

Previous Studies

No records were found of any previous studies in the soils phase of salinity in the study area.

Most of the principal previous sediment investigations have been made by technicians of the U. S. Forest Service, Corps of Engineers, Geological Survey, and Soil Conservation Service. Data in the files of the Forest Service and Soil Conservation Service are related to upstream sediment-source surveys, sedimentation damages to farm ponds and small reservoirs and valley damage and suspended-sediment studies in tributary and smaller stream valleys. The Corps of Engineers has obtained data from observational studies and surveys of larger reservoirs and major valleys and stream courses, particularly in the Savannah and Apalachicola-Chattahoochee-Flint basins. The Geological Survey has established intermittent suspended-sediment sampling stations on some of the rivers and their major tributaries in the study area.

In developing flood prevention survey reports and watershed work plans, the Soil Conservation Service and the U. S. Forest Service correlated many of the previous studies and augmented these data with additional studies.

Likewise, sediment investigations for certain projects by the Corps of Engineers were made in conjunction with project surveys basic to their proposal, authorization and ultimate construction. Where advisable, continuing recordings of sedimentation data are being made on completed works. Generally, the Corps of Engineers sedi-

ment investigations have not been of sufficient duration for establishing any definite conclusions.

Some of these studies were conducted to determine the sedimentation problem at specific locations. Others are of a continuing or recurring nature and are expected to show progressive sedimentation features as modified by time and treatment.

There are three reservoirs in the study area for which the Soil Conservation Service has compiled some sedimentation survey data. A summary of the survey data is shown in Table 2.78.

The rates at which sediment accumulates in reservoirs may vary considerably. It is significant that in the two cases in which later surveys provided bases for computing sedimentation rates for subsequent intervals of time, the rates had decreased noticeably. The reduction of 78 percent in the sediment yield noted after a resurvey of the Newnan Reservoir is believed to be the result primarily of changed land use and of considerable land treatment measures installed on cropland, pastureland, woodland, and other land.

In the course of small watershed planning activities, the Soil Conservation Service has been engaged actively for some time in predicting sediment accumulation at floodwater retarding structure storage requirements and capacity equivalents of sediment volume for sites considered as representative. These storage requirements are for 50 years accumulation of sediment. Changing rates of sediment production are taken

TABLE 2.77

Sediment Storage Requirements in the Soil Conservation Service Floodwater Retarding Structures Constructed in a Watershed in the Southeast River Basins and Considered Representative of the Study Area (Blue Ridge)

Watershed	Structure number	Drainage area (sq. mile)	Sediment storage (acre-ft.)	Capacity equivalent sediment volume (inch)
Sauvie Creek Georgia	10	3.0	105	0.64
	12	1.9	65	0.64
	13	2.9	100	0.64
	18	2.3	81	0.64
	22	0.9	32	0.64

into consideration in making the predictions. Present land use and trends in land use in the study area are such that the predicted effect of the changes has been to lower rates.

No floodwater retarding structures have been constructed by the Soil Conservation Service in the Coastal Plain portion of the Southeast River Basins area. To develop the capacity equivalent, it was assumed that sediment production would be uniform throughout the watershed above the site. These data provided means for comparison; and it is significant that they indicate considerable variation in sediment yields, not only from watershed to watershed in a basin but also from site to site within a watershed.

TABLE 2.78
Reservoir Sedimentation Data

Reservoir	Drainage area (sq. mile)	Date of survey	Period between surveys (year)	Storage capacity (acre-ft.)	C/W Ratio (acre-ft. storage/sq. mile D.A.)*	Average annual sediment accumulation (acre-ft.)	(ton)
Savannah basin		June 1938	---	1,836	131	---	---
Lake Issaqueena, S.C.	14.02	Apr. 1941	2.9	1,748	125	2.22	2,410
Altamaha basin		Oct. 1949	8.5	1,626	116	1.03	1,140
Lloyd Shoals, Ga.	1,414.0	Dec. 1910	---	112,538	79.6	---	---
		Mar. 1935	24.3	98,578	69.7	0.48	533
A-C-F basins		June 1924	---	384	276	---	---
Newnan	1.39	Nov. 1937	13.4	358	258	1.45	1,580
		Feb. 1945	7.3	354	255	0.41	446

* Capacity/watershed ratio is the acre-feet of storage per square mile of drainage area.

TABLE 2.79

Sediment Storage Requirements in the Soil Conservation Service Floodwater Retarding Structures Within the Southeast River Basins Area (Piedmont in Georgia)

Watershed	Structure number	Drainage area (sq. mile)	Sediment storage (acre-ft.)	Capacity equivalent sediment volume (inch)
Palmetto Creek	1	4.42	89	0.38
	6	2.05	52	0.48
	10	3.68	77	0.39
Potato Creek	33	1.08	44	0.76
	56	6.48	138	0.40
	58	4.56	104	0.43
	66	7.55	164	0.41
	78	6.60	136	0.39
	82	4.82	110	0.43
	89	13.13	150	0.21
	103	2.16	50	0.43
Rooty Creek	20	1.7	34	0.38
	21	1.8	30	0.38
	5	1.4	30	0.38
	25	1.6	32	0.38
Barber Creek	6	5.78	211	0.68
	9	2.00	76	0.68
	25	1.25	46	0.68
	26	2.06	75	0.68
Hazel Creek	7	1.80	44	0.459
	12	2.86	57	0.374
	19	1.50	27	0.327
	21	1.92	21	0.498
Sandy Creek	8	3.1	65	0.39
	12	2.0	56	0.54
	14	1.5	58	0.74
	15	4.2	110	0.45
	18	1.4	52	0.71
	23	4.1	87	0.39

Table 2.80 illustrates the type of damages in some selected watersheds which are considered representative of the study area. Estimates of the kinds and amounts of sediment damages are incomplete. Not until needed surveys are carried out over a period of years can adequate appraisal of sediment damage be made. The full extent of damages can be expected to be very much larger than shown in this table. The estimated annual sediment and erosion damage is for some small watersheds in Georgia in 1960. Where dollar estimates are not indicated in Table 2.80, it means that the damage is not significant.

Existing Sediment Control Data, Works, and Programs

Individual land owners and operators have applied many measures for conserving and improving croplands, pasturelands, rangelands, and woodlands of the study area. Between 40 and 50 percent of all needed measures have been applied to date on the croplands, pasturelands, and rangelands. This has been an effective factor in reducing sediment production. Many of the measures consist of vegetative stabilization and management measures but also included are numerous grade stabilizing and sediment trapping structures. The more than 33,000 farm ponds in the study area as of 1960 have a very large collective sediment trapping capacity.

There are also a number of larger lakes and reservoirs, privately and publicly constructed, that are trapping considerable quantities of sediment. Many of these were constructed with planned sediment storage capacity.

TABLE 2.80
Sediment and Erosion Damages in Some Small Watersheds

Watershed	Basin	Area (sq. mile)	Average annual sediment and erosion damage			
			Overbank deposition	Flood plain scour	Roadbanks	Reservoirs
Piedmont province						
Barber Creek	Altamaha	42	\$634			
Palmetto Creek	A-C-F	21	947	\$324		
Sandy Creek	Altamaha	33	4,415	91		
Rooty Creek	Altamaha	46	2,740	869		
Hazel Creek	A-C-F	31	307	2,656	\$216	
North Broad River	Savannah	73	1,252	91	968	
Blue Ridge province						
Sauvie Creek	A-C-F	31	1,759		117	\$237
Coastal Plain province						
Little Satilla Creek	Satilla-St. Marys	164				\$55

Some bank stabilizing measures, particularly in upstream watershed areas, have been constructed on the streams in the basins. These measures prevented sediment and bedload contribution to streams from bank erosion. The accumulative effect of these works and programs has resulted in a downward trend in sediment in the rivers in the study area. Table 2.81 illustrates the effects of these facilities have been a reduction of turbidity of water at five locations.

TABLE 2.81
Average Annual Turbidity of Water
At Five Georgia Waterworks Plants
1934 - 1960
(parts per million)

Year	Atlanta	Macon	State hospital	Augusta	Columbus
1934	400				
1935	335	216			
1936	370	224			
1937	280	161			
1938	260	148			
1939	312	163	417		
1940	200	131	212	90	
1941	248	133	125	59	
1942	244	147	168	107	
1943	224	110	142	104	
1944	158	83	109	78	
1945	182	105	121	95	85
1946	150	79	99	65	59
1947	118	79	108	67	42
1948	126	67	96	57	48
1949	123	58	78	43	31
1950	76	45	62	44	29
1951	88	45	86	58	35
1952	69	63	45	41	33
1953	76	51	44	26	36
1954	68	29	28	25	21
1955	61	42	25	25	19
1956	54	72	40	33	20
1957	29	83	38	25	19
1958	27	72	36	29	19
1959	25	82	41	25	15
1960	23	72	52	26	12

Piedmont Province Sediment Delivery Rates

Figure 2.9, Sediment Delivery Rate Versus Size of Drainage Area, plots some sediment delivery rates determined from reservoir surveys and detailed examination of erosion conditions in the watersheds of the reservoirs. The resultant curve is considered adequate for detailed planning estimates in that part of the Southeast River

Basins area which lies in the Piedmont province and thus is applicable to the Savannah, Ogeechee, Altamaha, and Apalachicola-Chattahoochee-Flint basins.

Figure 2.10, Estimated Average Annual Sediment Yield-Piedmont Province, is a graphic representation of annual sediment yield, in tons per square mile of drainage area per year, at sites below drainage areas of the sizes indicated and in which the rate of gross erosion is 5,600 tons per square mile per year. This annual gross erosion rate of 5,600 tons per square mile is merely an average for the Piedmont as a whole and, except in the case of a pure coincidence, would not apply as a reasonable accurate estimate for use at any given site unless the watershed above the site were several thousand square miles in area. This may be emphasized by the wide range in rates of gross erosion in the watersheds above 18 sites studied by the Soil Conservation Service. The average annual rates of gross erosion above these sites vary from 3,205 to 9,726 tons per square mile. Figure 2.10 should not be used for detailed planning purposes. Detailed planning will necessitate a study of the watershed above any given site to determine the rate of gross erosion. After this has been done, a sediment delivery rate may be taken from the curve, Figure 2.9, and applied to the gross erosion to determine the amount of sediment yield. Data similar to Figures 2.9 and 2.10 were not available for other geographic areas. However, the average annual rate of gross erosion in the Blue Ridge is about 2,500 tons per square mile. Sediment delivery rates vary considerably and sufficient data have not been collected to develop reliable delivery rate curves for the Blue Ridge. Of eight single studies made in the Coastal Plain, sediment production was negligible in five sample areas. A summary of the amount of erosion and sediment yield in the other three sample areas is shown in Table 2.82.

As the aggregate area of the eight samples represents less than 1 percent of the study area portion of the Coastal Plain, generalizations cannot be made as to the average rate of erosion for the Coastal Plain.

Comparisons may be made with the above information between the Piedmont, Blue Ridge, and Coastal Plain in the study area and data from other parts of the United States. Prelimi-

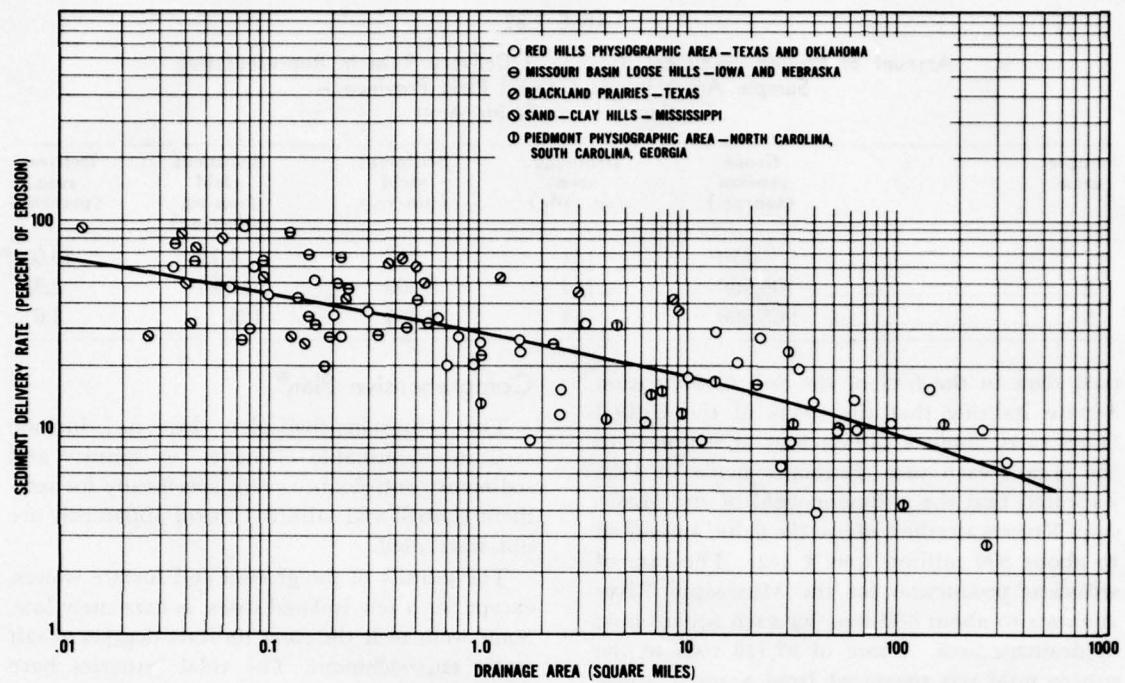


Figure 2.9 *Sediment Delivery Rate Versus Size of Drainage Area.*

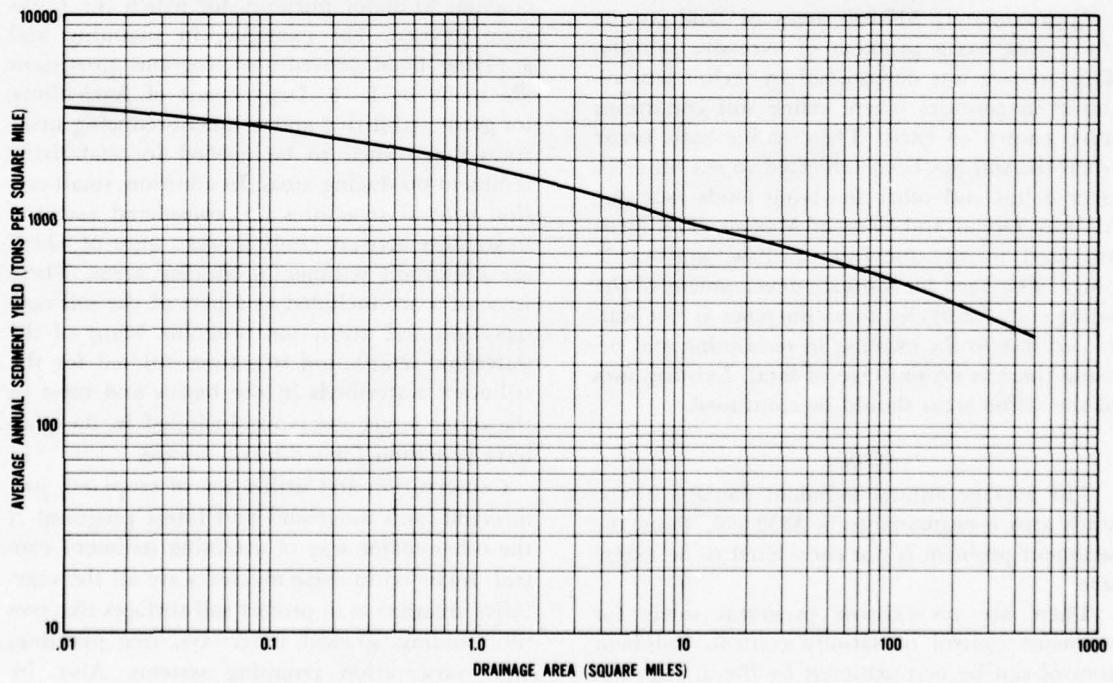


Figure 2.10 *Estimated Average Annual Sediment Yield — Piedmont Province.*

TABLE 2.82
Amount of Erosion, Sediment Yield, and Delivery Rate in Representative
Sample Areas in the Coastal Plain Province —
Southeast River Basins Area

Sample area	Gross erosion (ton/yr.)	Drainage area (sq. mile)	Sediment yield (ton/yr.)	Sediment yield (ton/sq. mile-year)	Delivery rate (percent)
1	370	151	260	1.72	70.0
2	105,900	164	2,500	15.24	2.38
3	268,900	64	8,065	126	3.0

nary data in the files of the Soil Conservation Service indicate that the rivers of the United States carry about 1 billion tons of sediment to the oceans each year. Estimates made in 1952 indicated that the sediment yield of the Mississippi River watershed, above the delta, amounted to about 500 million tons a year. The rate of sediment production for the Mississippi River amounts to about 400 tons for each square mile or drainage area. A rate of 97,740 tons to the square mile was measured from a small watershed in the Missouri River Basin in western Iowa.

Saline Soils

Approximately 517,000 acres of land in the study area has a problem of excessive salinity. This acreage was determined by technicians residing in counties where saline soil conditions were known to exist. These saline soils occur when the soil has been subjected to sea water in river deltas and other low-lying lands near the Atlantic Ocean and Gulf of Mexico. The areas are used mainly for fish, wildlife, and cattle range. The need for resource development of the saline soils for agricultural purposes is not warranted due to the expense in reclaiming and because there is no shortage of land. Existing uses of the saline areas should be continued.

Other

The average annual sediment damage in the study area is estimated to be \$852,000. Thus, the sediment problem is not considered to be extensive.

There are no existing programs solely for sediment control or salinity control. Sediment control can be best achieved by the application of vegetative and mechanical practices as a part of the land treatment program.

Comprehensive Plan

The comprehensive plan does not include separate identifiable elements for salinity and sediment control since plans specifically for sediment control and salinity control apparently are not warranted.

The salinity of the ground and surface waters, except for a few isolated cases, is extremely low. Some wells near the coast indicate degrees of salt water encroachment. The tidal estuaries have normal salinities.

Most sediment control, under existing, authorized, or proposed programs will come about incidental to major purposes for which the works were devised. For example, in planning and applying flood prevention programs provisions are made by U. S. Department of Agriculture for grade stabilizing and sediment-reducing structures determined to be needed for stabilizing sediment-producing areas. In addition, small erosion control structures are considered essential to stabilize actively eroding areas, most of which are important sediment-producing areas. These structures are included as a part of the soil conservation and utilization program. Many of the waterflow retardation structures studied for the tributary watersheds in the basins and most of the other larger reservoirs included in the plan have provision for sediment storage.

Conservation and utilization of cropland, pastureland, and rangeland and forest programs is the other major way of attaining sediment control. Included in these measures are all the vegetative treatments to protect soil surfaces like pasture seeding, grassed waterways, tree planting, and conservation cropping systems. Also, included in the land treatment program and effective in sediment control, are the cultural and

management measures designed to make vegetation a better erosion-controlling agent. These include pasture and range management measures on about 3.4 million acres. Many of the mechanical measures included in the land-treatment program not only make the vegetative measures more effective, but also have direct effect on stopping, trapping, or retarding movement of sediment. The mechanical measures include 90,000 planned farm ponds by 2000.

It is estimated that sediment production from sheet and gully erosion and damage caused by this sediment, in those areas of the Piedmont where complete land treatment can be established, will be reduced by about 50 percent. It is expected that in the Upper Coastal Plain, where sediment yields are considerably lower than in the Piedmont, a reduction considerably less than that which might be expected in the Piedmont, but appreciable nevertheless, would be effected. In all probability, the low sediment yields from the Lower Coastal Plain cannot be reduced significantly.

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

U. S. Department of Agriculture, Soil Conservation Service:

Technical Memorandum — Sediment Control. Soil Conservation Service. Ogeechee, Satilla-St. Marys basins, February 1961; Suwannee, Ochlockonee, and Choctawhatchee-Perdido basins — March 1961; Savannah — April 1961; Altamaha and Apalachicola-Chattahoochee-Flint basins — May 1961.

Contents of these technical memorandum range from 6 to 18 pages. Contained therein are existing sedimentation data, present sediment damage by geographical areas in each basin, factors affecting sediment production, discussion on adequacy of existing programs, existing and future needs for sediment control and conclusions that plan development for sediment control exclusively, are not justified. Three tables include reservoir sedimentation survey data, sediment storage requirements in the Soil Conservation Service floodwater retarding structures in the Piedmont and Blue Ridge.

Technical Memorandum — Soil Conservation and Utilization.

Contains basin inventories of saline soil problems as follows: Savannah — item IV, page 12; Ogeechee — item III, pages 11 and 12; Satilla-St. Marys — item IV, pages 11 and 12; Suwannee — item IV, page 11; Ochlockonee — item IV, page 11; Apalachicola-Chattahoochee-Flint — item IV, page 12; Choctawhatchee-Perdido basins — item IV, page 11. Locates areas and estimates acres of saline soils by counties, describes the area involved and impacts.

U. S. Department of Health, Education and Welfare. *Water Quality Basic Data, Southeast River Basins.* Public Health Service, 1961.

A compilation of available water quality data.

U. S. Geological Survey. *Hydrologic Characteristics of the Southeast River Basins.* Water Resources Division, 1960, 385 pages.

References to sediment in this document include streams for which compilations have been made of concentrations of suspended sediment, and estimates sediment yield.

Other references used:

State Water Pollution Control Board. *Water Quality Criteria,* Sacramento, California, 1957.

A compendium of technical and legal literature pertaining to water quality criteria for beneficial uses of water.

U. S. Department of Agriculture. *Yearbook of Agriculture, Water 1955.* Pp. 321-7, Irrigation, Water and Saline and Alkali Soils.

General discussion on saline soils and water, salinity, salinity control, salinization of soil and salt water encroachment into fresh water.

U. S. Department of Agriculture. *Diagnosis and Improvement of Saline and Alkali Soils,* U. S. Salinity Laboratory Staff, U. S. Department of Agriculture Handbook, number 60, February 1954, 160 pages.

Includes chapters on origin and nature of saline soils, determination of properties of saline soils, plant response and crop selection for saline soils and methods for soil characterization.

Brune, Gunner M. *Sediment is Your Problem, Wasted Soil and Water,* U. S. Department of Agriculture, AIB 174 March 1958, 15 pages.

Discusses and illustrates how sediment affects soil and water and man's facilities, where sediment comes from, what can be done to alleviate the problem and describes the effectiveness of soil conservation as an alternative sediment control measure.

Supplemental Data

Supplemental information included here are Work Plans for Salinity Control and Sediment Control. Other supporting details on salinity and sediment are in the files of the U. S. Study Commission.

WORK PLAN — SALINITY CONTROL

(edited to delete administrative details)

I. *Introduction*—Public Law 85-850 requires the investigation, study, survey and planning for salinity control.

Salinity in water is defined as the degree of saltiness of surface and ground waters. It is a measure of water quality. Soils that contain too much soluble salt are called saline soils.

Salinity influences the development of land and water resources and may control the economy of certain commercial enterprises, such as shell fisheries.

For the purpose of this study, salinity control is defined as remedial or prevention measures, including water and land utilization, necessary to prevent or reduce (1) degradation of surface and ground waters by naturally occurring saline substances and (2) improvement of saline

soils where alternative uses of such soils are needed and feasible.

Salinity in excess of that usually found in comparable surface and ground waters is considered to be water pollution. Salinity known to result from discharges of industrial water will be considered under "pollution abatement" in the report.

II. Objective—To determine the existence, extent and pattern of salinity problems in the study area and to develop, if needed, a feasible plan for protecting and improving water quality by control or reduction of salinity.

III. Guidelines—There is little recorded information on salinity problems in the study area. Lack of information leads to the conclusion that problems are not wide-spread or well delineated. Therefore, a reconnaissance survey will be made in the initial stage of the salinity studies. Such survey will determine geographical location of the salinity problems, the physical feasibility of salinity control in the area, the economic feasibility of salinity control programs in the area, determine the extent and adequacy of existing salinity control programs and will contribute to determining future salinity control needs. If additional detailed studies appear to be warranted within given areas, such studies will be accomplished within budgetary and time limits.

It is anticipated that salinity control in the future may be of an increasing order of magnitude as demands arise for land and water resources. Thus, projections must be made only after careful analysis of inventory data and projected land and water uses.

IV. Work Outline

A. Definitions, planning criteria, standards

(To be determined by USSC staff member and/or functional committee)

B. Technical tasks

1. Basic data

a. Inventory of existing programs and facilities and adequacy thereof

(1) Industrial and municipal treatment of saline waters (cities and industries to be determined)

(2) Extent and types of agricultural chemical amendments to saline soils for replacement of absorbed sodium and other elements (USDA, Exper. Stations)

(3) Specify other programs and facilities found during the investigation (public and private)

b. Inventory of existing problems

(1) Determine existing location and extent of areas where salinity is a problem in:

(a) ground waters (USGS)

(b) surface waters (USGS)

(c) saline soils¹ containing excessive amounts of soluble salts (USDA, Exper. Stations)

(I) extent of flocculated saline soils (USGS)

¹ Saline soils, denote a soil for which the conductivity of the saturation extract is greater than four millimhos per cm, and the exchangeable-sodium-percentage is less than fifteen.

(2) extent of artificially induced leaching of saline soils by such management practices as selection of crops, land preparation, tillage methods and irrigation leaching (USDA)

(d) saline water encroachment on fresh water supplies (USGS)

(e) extent of salinity problems resulting from

(1) heavy fertilization (USDA) (College Exper. Stations)

(2) irrigation with saline or brackish waters (USDA) (Exper. Stations)

(2) Determine effect salinity now has on

(a) agriculture (crops, irrigation water, land use, etc.) (USDA)

(b) restrictions on use of industrial, municipal and domestic water supplies due to abnormal saline content (HEW)

(c) fish and wildlife (FWS)

(d) other — specify

(3) Estimate losses from abandonment of agricultural lands resulting from intense saline conditions (USDA)

(4) Determine requirements for reclaiming saline soils (USDA) (Exper. Stations)

2. Analysis of the above and of any additional basic data acquired during the inventory and study period.

3. Need for resource development

a. Estimate of future needs for salinity control at least to the years 1975 and 2000 (including where applicable national, regional, physiographic region and SERB area needs)

(1) Analysis of population and physical factors influencing needs for salinity control, including the number and geographical location of salinity control facilities needed for the anticipated population.

(2) Analysis of economic factors influencing needs for salinity control.

(3) Analysis of financial, physical and economic benefits of existing and prospective Federal works constructed or to be constructed for salinity control. Proposals for construction and operation of Federal works. Functions and activities of Federal departments and agencies.

(4) Same type of analysis as in (3) above for private facilities, dependent upon availability of data.

(5) Salinity control program development if needed but not included in above items (if not included in 3 and 4 above include programs needed for agricultural purposes; for water supplies; fish and wildlife and other specified purposes).

(6) Estimated costs and benefits of salinity

control programs, projects or facilities

- (a) tangible or direct costs and benefits
- (b) intangible or indirect costs and benefits

(7) Determine cost, time involved and feasibility of these special studies.

- (a) Saline water conversion to other uses
(Office of Saline Water, U. S. Dept. of Interior and its contractors such as Nuclear Development Assoc., Inc. and Ionics, Inc.; U. S. Dept. of Defense and its contractors such as National Science Foundation; AEC; Federal Civil Defense Administration.
- (b) Extraction of chemicals and minerals from seawater (chemical companies, USDI)
 - (1) Determine feasibility and applicability of the processes:
 - (a) multiple-effect evaporation
 - (b) flash evaporation
 - (c) vapor - compression distillation
 - (d) ion-exchange principle with resins added
 - (e) other (specify)
- (c) Improvement of brackish waters
(USGS) (USDA)

4. Develop a salinity control program, at least to the years 1975 and 2000 by:

- a. Single-purpose alternative plan¹
 - (1) Primary salinity control program
 - (2) Multiple-purpose salinity control program
 - (3) Maximum salinity control needs
 - (4) Factors in implementing programs - cost, legislation, management of program and federal, state, local and private or combination participation.
 - (5) Relation of salinity control to other functions
 - (a) Fish and wildlife
 - (b) Sediment control
 - (c) Pollution abatement
 - (d) Soil conservation and utilization
 - (e) Reclamation and irrigation
 - (f) Drainage
 - (g) Water supplies
 - (h) Other
 - (6) Analysis of alternative programs and plans to meet salinity control needs
- b. Formulation of modified functional, single-purpose plan²

5. Develop list of technical memoranda needed in accordance with above tasks

C. Technical Programming
(Administrative details)

WORK PLAN - SEDIMENT CONTROL

(edited to delete administrative details)

I. *General* - Public Law 85-850, 85th Congress, provides for an (1) integrated and comprehensive investigation, study and survey of the land and water resources in the U. S. Study Area in order (2) to formulate a comprehensive and coordinated plan for several functions mentioned in the Act.

Sediment control is in the list of functions to be included in plans for land and water resource development.

Sediment is the product of erosion and consists of organic and inorganic undissolved solids. It may be transported as suspended load and bed load in flowing water, or may be transported by wind (extent of the latter source of sediment in the Study Area is not known). The following may result in the production of sediment: (1) The action of water concentrated in gullies, intermittent streams and water courses; and (2) raindrop splash on exposed soil.

Sedimentation results in the silting of reservoirs and stream channels, aggravates flooding and flood damages and influences the usability of water supplies. Damaging sedimentation can be best reduced by programs of land treatment or erosion control practices and structural programs for conserving and improving farm, range and forest lands as well as structural measures needed in water-flow-retardation systems. It is assumed that erosion-control practices are generally preferable to other methods of reducing sediment damage because they remove the basic cause of the damage and benefit both the areas of erosion and the areas of sedimentation. Watershed treatment measures can reduce the amount of soil carried away by runoff and minimize the harmful effects.

The functional studies having a major interest in sediment control are water supply, navigation, irrigation, forest and soil conservation and utilization, fish and wildlife, recreation, flood control and pollution abatement. The planning for application of control measures will not be a part of this study but will be accomplished in forest and soil conservation and utilization and flood control studies.

II. *Objective* - The primary purpose of the study is to examine sediment yield and sources; extent of present sediment damage and determine the adequacy of existing sediment control programs. This will assist the Commission in predicting present and future sediment control needs and preparing a plan for meeting needs.

III. *Guidelines* - The study will include an investigation of existing sediment conditions and estimation of needs for future sediment control at least to the years 1975 and 2000. All aspects of sedimentation for which data are available or obtainable will be inventoried. Inventory information will be obtained mostly from Federal agencies, State and local agencies and if available from

¹ The single-purpose plan will present an idealistic basis for meeting the needs for the salinity control function without consideration of other purposes or functions.

² The modified plan will include or exclude elements because of institutional, legal, financial, physiographic, physical or other reasons so as to recognize certain inevitable factors of development.

private organizations. After evaluating these data, it is anticipated that further study of some phase of sediment control will be necessary. Such additional studies will be of a quality suitable and to the extent needed in formulation of the comprehensive plan.

Time and budgetary limitations may restrict the intensity of such special studies. Special studies of sediment producing areas and of sediment control programs of the various agencies may be warranted. All reporting will be done where possible by basin physiographic provinces. Detailed reports will be made of those areas having special or difficult problems. It is doubtful if an extensive reconnaissance type survey of existing structural works for reducing sediment loads would substantially contribute useful information toward developing report material for the Commission staff.

On the basis of the basic data obtained and evaluated and results of the sediment control studies, report material will be prepared by the Commission staff.

IV. Work Outline

- A. Definitions, planning criteria, standards
(To be developed by staff members and committee)

B. Technical Tasks

- 1. Basic Data
 - a. Inventory of existing sedimentation data
 - 1. Location and data available at suspended sediment stations (CE, USGS)
 - 2. Data available on reservoir deposition (state and private organization)
 - 3. Estimates of magnitude of bed load (USGS)
 - 4. Methods used for predicting sediment (CE, USGS, SCS)
 - b. Inventory of extent of present sediment damage¹
 - 1. To flood plain lands and existing facilities including deposition of infertile material and overbank deposition (USDA, CE)
 - 2. To irrigation and drainage ditches (USDA, CE)
 - 4. To existing reservoirs, all types (Administering agencies, state and private organizations)
 - 5. To water quality for municipal and industrial use, including the effect of sediment on pollution abatement (PHS)
 - 6. To water quality for irrigation use (USDA)
 - 7. To water quality for fish and wildlife and recreational uses (FWS, State Game and Fish Commissions)
 - 8. Extent of aggradation and degradation above and below dams (USDA, CE)
 - c. Estimate of sediment production by sources² and locations

¹ Estimated average annual yield damage.

² Determine by physiographic provinces, where feasible.

- 1. Sheet and gully erosion, all lands (USDA)
- 2. Highways, railroads and airports (State highway boards, RR, Federal Aviation Agency)
- 3. Mines, quarries and other industrial installations (State Geology Mines and Mining Depts., PHS, USDA)
- 4. Flood plain scour (CE, USDA)
- 5. Erosion from drainage, irrigation, navigation and other channels (CE, USDA)
- 6. Stream bank erosion (USDA, CE)
- 7. Stream bed erosion (CE, USDA)
- d. Inventory of W/S project needs³ (Compile by watersheds) sediment damage reduction
 - 1. Acreage having the problem
 - 2. Acreage needing project action
 - 3. Number of farms
- 2. Analysis of basic data
 - a. Determine adequacy of existing sediment-control programs, works and activities. (Include those that are primarily for other purposes but have significant sediment control effects.)
 - 1. Determine effectiveness of land treatment measures, especially those for sediment control (USDA)
 - 2. Works for control of sediment from highways, railroads and airports (State Highway Boards, RR, Fed. Aviation Agency)
 - 3. Works for control of sediment from mines, quarries and other industrial installations (State Geology Mines and Mining Depts., PHS, USDA)
 - 4. Control work and other activities to reduce flood plain scour (CE, USDA)
 - 5. Bank and bed control works on channels for drainage, irrigation and navigation (SCS, ARS, Exper. Stations and CE)
 - 6. Bank and bed control works on major streams not included in 5 (CE)
 - 7. Structural works for reducing sediment loads or having significant sediment control effects on minor water courses (USDA)
 - 8. Facilities used for other purposes but having significant sediment control effects (specify purpose and agency involved)
 - b. Estimated quantities of measures and practices to meet projected sediment control needs at least to the years 1975 and 2000 as follows:⁴
 - 1. Land treatment measures
 - 2. On highways, railroads and airports
 - 3. For mines, quarries and other industrial installations

³ This data from Conservation Needs Inventory, USDA.

⁴ Items 2b, c, d and e will be accomplished by sub-work group and/or designated USSC staff member(s).

- 4. Specifically to reduce flood-plain scour
- 5. For banks and beds of drainage, irrigation and navigation channels
- 6. For banks and beds of major streams not included in 5
- 7. For minor water courses
- 8. Others — For example the number of small erosion-control structures considered essential to stabilize actively eroding sediment-producing areas
- c. Estimated quantities of sediment control measures and practices that can be established by present programs and activities at least to the years 1975 and 2000
- d. Estimated annual costs of present programs and activities
- e. Estimated extent to which sediment control will come about incidental to major pur-

poses existing, authorized or proposed programs. (See forest & soil conservation, drainage.)

- 3. Develop sediment control program at least to the years 1975 and 2000 by a:
- a. Single-purpose or alternative plan¹ (Include resources and interest to meet the needs)
- b. Modified single-purpose plan²

C. Technical Programming

(Administrative details)

¹ The single-purpose plan will present a single-purpose approach of meeting the needs for resource development by the sediment control function.

² The "modified" plan will include or exclude elements because of institutional, legal, financial, physiographic, physical or other reasons so as to recognize certain inevitable factors of development.

SECTION XV – POLLUTION ABATEMENT AND PUBLIC HEALTH

General Concept

In this study only those phases of public health programs directly related to land and water resources development are included. Items discussed include abatement of air and water pollution, collection and disposal of community and industrial solid waste, monitoring for radiation control, and control of vectors which includes mosquitoes, rodents, and other disease-carrying vermin.

In planning, data are needed regarding the present status of each program in order to establish present and estimate future needs and to evaluate the effects of present and future programs on the water and land resources. Estimates of future needs based on current practices and requirements were tempered by professional judgment to allow for expected trend and special conditions.

Plans for meeting the current needs of those phases of public health included in this Section and those which will develop by the year 1975 and 2000 are based on single-purpose requirements modified when appropriate for coordination into a comprehensive plan for multiple-purpose use. The plan includes pollution prevention, facilities for the treating of wastes before they are discharged to the stream, and impoundment of water for augmentation of low flows to maintain stream water quality suitable for reuse. A suggested criteria for sewage and

industrial waste treatment requirements, used in planning, is included as supplementary data in this Section. Programs in the field of air pollution and radiation monitoring are limited primarily to surveys and monitoring activities to provide adequate data, for regulatory agencies, necessary for control of the environment. Programs of collection and disposal of community and industrial solid wastes are planned to improve sanitation and provide effective means of handling solid wastes from all communities of 500 or more. Planning for the vector control program includes the development of contiguous coordinated districts for the entire coastal area.

The water pollution control program aims to prevent waste loading that would exceed the assimilating capacity of the receiving streams and maintain throughout the reaches of the streams water of suitable quality for reuse. The pollution abatement studies include all existing major sources of wastes, their volume and strength, status of waste treatment with points of discharge, and required treatment for maintenance of satisfactory stream quality throughout each basin. The responsibility for waste treatment is local, but any plan for resource development must include pollution abatement needs.

Cost data of sewerage systems including adequate treatment to maintain suitable stream water quality are needed for orderly planning.

Treatment is provided for all wastes and the degree of treatment is based on expected downstream water usage. Plant capacity is planned to provide for expected wastes load based on anticipated growth and developments within the life of the structure and is equal to or exceeds the estimated maximum loading. The degree of treatment is selected so as to be adequate to prevent adverse pollution of the receiving streams. Costs and benefits are considered in choosing alternate plans for meeting future requirements. Each function is required to pay its own way in multiple-purpose projects. Studies covering the waste treatment facilities include consideration of means of financing for construction, maintenance, operation, and rehabilitation.

Present practices of solid-waste disposal indicate a need for the installation of sanitary landfills for all towns of over 500 population. Incinerators are needed for the larger metropolitan areas to reduce the volumes of waste prior to their ultimate disposal in sanitary landfills.

The existing air pollution and radiation monitoring programs as they relate to land and water resources were studied in order to develop future needs. The extent of air pollution and its effect on population depend on population distribution, industrial, commercial, and agricultural activities, fuel usage, and waste disposal practices. Meteorology, topography, and other natural features influencing dispersion of pollutants are important factors for consideration in program development.

An adequate coordinated public health program, including in its scope all phases of the study, is essential for full development of the land and water resources of the basin. The expansion of existing vector control programs for areawide coverage coordinated with land and water management practices is planned to increase the effectiveness of limited programs.

The purpose of the studies is to establish guiding principles for detailed planning, setting forth as specifically as possible the costs and benefits of providing facilities to meet present and future needs and presenting recommendations on how to meet the needs. The Commission studies are not intended to take the place of detailed studies expected of consulting engineers engaged in planning specific works.

Work Plan

A work plan for the study of pollution abatement, an outline for presenting public health data, instructions for inventorying municipal and industrial wastes, and a discussion of pollution abatement low-flow augmentation benefits are included at the end of this Section. A working agreement was made with the Public Health Service to compile data gathered by State agencies in Alabama, Florida, and Georgia into technical memoranda. A copy of the work plan covering terminal studies for the comprehensive resource development and utilization is included as supplementary data in Part Two, Section VI, Water Supplies.

Work Performance

Basic information on public health programs and activities is available in files of the State public health departments. Field investigations were made to obtain inventory data necessary for updating and supplementing the existing information and establishing the adequacy of existing facilities. All municipalities and larger industries in the study area were inventoried as to the type and volume of waste and the treatment provided waste before discharged to the stream. Studies were made of other existing programs relating to their adequacy and effectiveness.

Inventory data provided a 1960 figure for population served by municipal sewer systems. In planning for future sewerage needs, it was assumed that all persons served by community water systems also should be served by community sewer systems except in places of less than 800 people. Treatment facilities were planned for each sewerage system to provide adequate treatment of all waste before discharged to streams. The degree of treatment was determined by the estimated assimilating capacity of the receiving stream; and where low streamflow of record is inadequate to properly handle the effluent from secondary treatment facilities, additional treatment or augmented streamflows were included. Where mutually beneficial, industrial wastes are combined with municipal waste for treatment. Where combined treatment of the waste is not feasible, separate industrial waste treatment facilities are included in the plan.

To develop a dollar value for meeting the needs, cost information on recently installed sewerage systems was obtained. The appropriate unit value applied to estimated population or population equivalent to be served by new or enlarged facilities gave a dollar value for the meeting of the needs. Costs of existing facilities of adequate capacity to meet present needs are not included.

Drafts of functional single-purpose work plans were prepared of the requirements for pollution abatement and public health programs. These work plan drafts, after review by the staff, were presented to the Committee on Pollution Abatement and Public Health which included members from the Alabama Water Improvement Commission, the Florida State Board of Health, the Georgia Department of Public Health, the U. S. Geological Survey, the U. S. Public Health Service, and staff members of the U. S. Study Commission. The committee was asked to review the functional work plan, to discuss problems involving inventories and making projections for meeting future requirements, and to set guidelines or benchmarks for development of work agreements to implement the work. Considering recommendations of the committee, the Study Commission firmed up functional work plans and developed a set of proposals for doing the work. At the second meeting of the committee, it was decided that allocation of work would be primarily to the States to gather and organize the data and to the Public Health Service to compile and make an analysis. Completion dates for functional memorandums in the pollution abatement and public health field were considered and work schedules adopted.

Contracts were made with the Florida State Board of Health and the Alabama Water Improvement Commission for collecting, summarizing, and reporting of basic data on water pollution, garbage disposal, vector control, air pollution, and radiation monitoring. The work by contractors was performed in accordance with accepted sanitary engineering practices and in keeping with Commission specified outlines based on the desired type of presentation. Outlines of the basic data required were furnished to the contractor.

Data for the South Carolina portion of the basin were collected, with State approval, by the

U. S. Public Health Service from the central files of the State. A separate agreement of the Public Health Service arranged for the collection of data and field inventories to supplement the available data of the Georgia portion of the Southeast River Basins area. Three engineers and one stenographer were loaned to the Georgia Department of Public Health by the Public Health Service for the purpose of obtaining the necessary data. A special office designated as the Water Resources Survey was established by the Georgia Department of Public Health for the purposes of inventorying all municipal and industrial wastes systems. These data collected as a State function were transmitted to the Public Health Service and used in development of technical memoranda for the river basins. The Communicable Disease Center of the Public Health Service assigned special personnel for collecting data in other allied public health fields.

Pollution Abatement Low-Flow Augmentation Benefits

An estimate was made of the benefits that would accrue from the storage of water for the augmentation of low flows for pollution abatement. Instead of assuming that the benefits would be at least equal to the costs of storing water for release, a dollar benefit value was determined for the low-flow augmentation storage based on the costs of a tertiary treatment plant sized to reduce the 5-day biochemical oxygen requirements of secondary treatment plant effluent. The cost of the cheapest alternative method is frequently taken as a monetary benefit or at least as a limit of the benefits. This was the premise upon which the estimate was made.

A number of assumptions, most of which had been established by the Commission, were used. Dilution was not substituted for treatment as a solution to pollution and no benefits are considered prior to secondary degree of treatment for all wastes discharged. The effectiveness of treatment was established as 35 percent removed by primary and 85 percent removed by secondary treatment. A removal of an additional 80 percent, for a total of 97 percent, was assumed for tertiary treatment following secondary treatment. All removals were based entirely upon the biochemical oxygen demand of organic wastes. In estimating the required releases for low-flow aug-

mentation, only the oxygen requirements of the treated wastes were considered. The costs of various types of treatment were established and costs of stabilization ponds based on a loading of 35 pounds of BOD per acre were used for evaluating the tertiary treatment. Stream water quality below the waste discharge was established with a minimum dissolved oxygen concentration of 4 parts per million based on various water use requirements. It was assumed that the water in the stream above the point of discharge would be 90 percent saturated and that the dissolved oxygen concentration at the time of low flow would be approximately 7 parts per million. The magnitude of the low flows was determined on the basis of the 7 consecutive day minimum flow which would occur on an average of once in every 10 years. The relationships between draft and storage were based on an analysis made by the Study Commission. The BOD loading was based on 0.17 pounds per person and the loading on the plant was determined by population projection for the study area. It should be emphasized that the oxygen requirement of the treated wastes was the sole index used in determining the benefits, which would accrue from low-flow augmentation or by the installation of tertiary treatment.

If tertiary treatment is to be substituted for the augmentation of low flows, then it is necessary to construct a plant of adequate capacity to fulfill the requirements under the maximum adverse condition. It is obvious that the additional treatment may not be required at all times to maintain the established minimum oxygen concentration, but it is, however, necessary to construct the plant and have it available at all times. Cost estimates were made for tertiary treatment based on BOD loading of effluents from secondary treatment plants serving towns with varying populations from 2,000 to 20,000 people. These costs were then evaluated to the BOD removal afforded by the treatment plant. The reduction in oxygen demand was then equated to the available oxygen (3 p.p.m.) in the water of the receiving streams, and the value of an acre-foot of water to replace the indicated degree of treatment was established using the amortized cost of the tertiary treatment plant. A curve was then plotted on the basis of the population served by the treatment plant. A minimum value of \$50

per acre-foot was established as an estimate of the benefits. Such benefits could be claimed each time the water, after assimilating the discharged waste, has by natural reoxygenation replenished the oxygen used. Storage requirements are determined by the city requiring the largest amount of augmented flow. Where waste discharge points are too close together to permit oxygen buildup between cities, storage was provided for the combined loading. For the purpose of cost allocation, the alternative cost of a single-purpose reservoir for pollution abatement was used unless the minimum annual benefits of \$50 per acre-foot of water were less than the alternative cost.

Coordination

The activities of the State health departments and U. S. Public Health Service and the collecting, summarizing, and reporting of data were coordinated by the staff specialist for water use and public health guided by the functional committee mentioned above and by the Land Group and Water Group. The staff specialist developed guidelines outlining the requirements of the study to assure that data were complete and technical memorandums would be adequate for the need of the planning engineers.

Findings

Under work plan agreements, the U. S. Public Health Service developed a technical memorandum for water supply, pollution abatement, and public health for each of the eight river basins of the Southeast River Basins area. These memoranda include a listing of all existing sewerage systems, industrial waste outfalls, and programs in the fields of solid-waste disposal, air pollution monitoring, and vector control. An appraisal was made as to the adequacy of all germane public health programs considering the present and future needs, based on population projections for each community adjusted to the economic framework. The estimated needs were developed as single-purpose projects to meet specific requirements. Costs were established for each project and it was assumed that the benefits would be at least equal to the costs. A dollar benefit value was determined for low-flow augmentation storage based upon the 5-day biochemical oxygen requirements of secondary treatment plant effluents. In developing the costs, alternative methods were considered and the most economic plan

adopted. The sewage facilities needs are tabulated showing the degree of treatment required for each of the municipal systems. In planning, provisions were made in some cases for treating certain types of industrial wastes combined with domestic sewage. However, separate industrial treatment plants have also been included in the overall plan. The industrial waste treatment facilities are not tabulated in this Appendix since it would be difficult to tabulate the types and degree of treatment afforded by separate facilities and clearly indicate the number of industries which discharge their waste to municipal systems.

The effectiveness of existing vector control programs was noted and used as a base for planning future programs for effective vector control throughout the Southeast River Basins area.

Sanitary landfills are being operated by some communities. This method of solid-waste disposal is planned for all places with population of 500 or more. Incinerators are needed to reduce the volumes of wastes of the large urban areas. The disposal of these solid wastes will require over 12,000 acres of land by the year 2000. The program will reclaim marginal land for higher use and will add to the effectiveness of the vector control programs.

TABLE 2.83
Sewerage Facilities

Basin	Year	Municipal population served	Number of places*	Type of treatment		
				None	Primary	Secondary
Savannah	1960	404,900	(11)	62	28	19
	1975	735,000	(11)	83	---	22
	2000	1,300,000	(11)	94	---	24
Ogeechee	1960	64,700	(2)	13	5	3
	1975	136,000	(2)	18	---	---
	2000	230,000	(2)	22	---	---
Altamaha	1960	537,500	(8)	68	28	20
	1975	993,000	(8)	75	---	10
	2000	1,637,000	(8)	83	---	10
Satilla-St. Marys	1960	70,000	(4)	17	5	4
	1975	148,000	(4)	27	---	2
	2000	273,000	(4)	30	---	2
Suwannee	1960	113,200	(3)	28	8	9
	1975	203,000	(3)	51	---	2
	2000	350,000	(3)	70	---	2
Ochlockonee	1960	86,200	(4)	16	3	3
	1975	170,000	(4)	23	---	1
	2000	297,000	(4)	28	---	1
A-C-F	1960	973,800	(13)	103	40	27
	1975	1,968,000	(13)	105	---	26
	2000	3,718,000	(13)	113	---	23
Choctawhatchee-Perdido	1960	263,700	(13)	68	24	11
	1975	656,000	(13)	95	---	25
	2000	1,284,000	(13)	120	---	27
SERB area	1960	2,516,000	(58)	375	141	96
	1975	5,009,000	(58)	477	---	88
	2000	9,089,000	(58)	560	---	89

* Federal installations, State institutions, etc.—Each serving more than 50 persons are shown in parentheses and included in the total. All communities with sewerage systems in 1960 are included regardless of size. The population served figure was based on a factual inventory and may not agree with the census figure. For the years 1975 and 2000, all communities with population of 800 or more and those smaller with existing sewerage systems are considered as serving the entire estimated population.

TABLE 2.84
Pollution Abatement Costs—2000
(thousands of dollars)

Basin and purpose	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Savannah					
Municipal	70,648.0	813.2	1,708.0	500.1	2,208.1
Georgia	46,175.0	537.9	1,076.2	324.9	1,401.1
South Carolina	24,473.0	275.3	631.8	175.2	807.0
Industrial	40,030.5	873.1	1,060.6	579.9	1,640.5
Georgia	31,828.0	680.7	815.5	435.3	1,250.8
South Carolina	8,202.5	192.4	245.1	144.6	389.7
Pollution	110,678.5	1,686.3	2,768.6	1,080.0	3,848.6
Georgia ¹	78,003.0	1,218.6	1,891.7	760.2	2,651.9
South Carolina	32,675.5	467.7	876.9	319.8	1,196.7
Ogeechee					
Pollution	27,251.2	202.7	636.7	120.6	757.3
Municipal	26,731.0	171.1	623.1	102.0	725.1
Industrial	520.2	31.6	13.6	18.6	32.2
Altamaha					
Pollution	152,883.0	2,644.6	3,706.2	1,525.8	5,232.0
Special ²	23,612.0	167.8	708.4	130.7	839.1
Municipal	125,609.0	2,407.7	2,902.5	1,369.2	4,271.7
Industrial	3,662.0	69.1	95.3	25.9	121.2
Satilla-St. Marys					
Municipal	19,896.5	256.2	462.2	148.8	611.0
Florida	3,745.5	59.8	95.2	35.2	130.4
Georgia	16,151.0	196.4	367.0	113.6	480.6
Industrial	1,006.4	63.6	25.7	36.2	61.9
Florida	207.5	18.9	5.2	10.6	15.8
Georgia	798.9	44.7	20.5	25.6	46.1
Pollution	20,902.9	319.8	487.9	185.0	672.9
Florida	3,953.0	78.7	100.4	45.8	146.2
Georgia	16,949.9	241.1	387.5	139.2	526.7
Suwannee					
Municipal	35,750.0	512.3	918.2	295.4	1,213.6
Florida	11,928.0	160.5	304.0	90.3	394.3
Georgia	23,822.0	351.8	614.2	205.1	819.3
Industrial	4,342.5	106.5	97.2	77.9	175.1
Florida	1,225.5	23.0	27.2	15.2	42.4
Georgia	3,117.0	83.5	70.0	62.7	132.7
Pollution	40,092.5	618.8	1,015.4	373.3	1,388.7
Florida	13,153.5	183.5	331.2	105.5	436.7
Georgia	26,939.0	435.3	684.2	267.8	952.0
Ochlockonee					
Municipal	25,694.0	326.7	595.5	183.5	779.0
Florida	18,980.0	231.1	433.8	130.2	564.0
Georgia	6,714.0	95.6	161.7	53.3	215.0
Industrial	4,863.0	58.5	117.3	35.6	152.9
Florida	2,158.0	18.5	55.1	11.2	66.3
Georgia	2,705.0	40.0	62.2	24.4	86.6
Pollution	30,557.0	385.2	712.8	219.1	931.9
Florida	21,138.0	249.6	488.9	141.4	630.3
Georgia	9,419.0	135.6	223.9	77.7	301.6

¹ Includes special project Savannah metropolitan area secondary treatment.
² Special project Atlanta metropolitan area tertiary treatment of wastes to South River.

(continued)

TABLE 2.84—Continued

Basin and purpose	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Apalachicola-Chattahoochee-Flint					
Municipal	319,287.0	3,415.6	7,402.7	2,052.2	9,454.9
Alabama	18,246.0	178.5	455.7	116.0	571.7
Florida	5,542.0	81.5	132.7	27.0	159.7
Georgia	295,499.0	3,155.6	6,814.3	1,909.2	8,723.5
Special	64,518.0	241.7	1,935.5	188.3	2,123.8
Alabama	--	--	--	--	--
Florida	--	--	--	--	--
Georgia	64,518.0	241.7	1,935.5	188.3	2,123.8
Industrial	11,418.0	132.8	319.0	75.4	394.4
Alabama	1,194.0	11.9	35.8	8.0	43.8
Florida	446.0	12.9	11.6	6.5	18.1
Georgia	9,778.0	108.0	271.6	60.9	332.5
Pollution	395,223.0	3,790.1	9,657.2	2,315.9	11,973.1
Alabama	19,440.0	190.4	491.5	124.0	615.5
Florida	5,988.0	94.4	144.3	33.5	177.8
Georgia	369,795.0	3,505.3	9,021.4	2,158.4	11,179.8
Choctawhatchee-Perdido					
Municipal	168,992.0	1,834.6	3,952.9	1,035.8	4,988.7
Alabama	28,622.0	306.5	750.2	191.5	941.7
Florida	140,370.0	1,528.1	3,202.7	844.3	4,047.0
Industrial	6,876.0	305.7	153.4	184.3	337.7
Alabama	706.0	205.3	16.4	120.6	137.0
Florida	6,170.0	100.4	137.0	63.7	200.7
Pollution	175,868.0	2,140.3	4,106.3	1,220.1	5,326.4
Alabama	29,328.0	511.8	766.6	312.1	1,078.7
Florida	146,540.0	1,628.5	3,339.7	908.0	4,247.7
Southeast River Basins					
Municipal	792,607.5	9,737.4	18,565.1	5,687.0	24,252.1
Alabama	46,868.0	485.0	1,205.9	307.5	1,513.4
Florida	180,565.5	2,061.0	4,168.4	1,127.0	5,295.4
Georgia	540,701.0	6,916.1	12,559.0	4,077.3	16,636.3
South Carolina	24,473.0	275.3	631.8	175.2	807.0
Industrial	72,718.6	1,640.9	1,882.1	1,033.8	2,915.9
Alabama	1,900.0	217.2	52.2	128.6	180.8
Florida	10,207.0	173.7	236.1	107.2	343.3
Georgia	52,409.1	1,057.6	1,348.7	653.4	2,002.1
South Carolina	8,202.5	192.4	245.1	144.6	389.7
Special	88,130.0	409.5	2,643.9	319.0	2,962.9
Alabama	--	--	--	--	--
Florida	--	--	--	--	--
Georgia	88,130.0	409.5	2,643.9	319.0	2,962.9
South Carolina	--	--	--	--	--
Pollution	953,456.1	11,787.8	23,091.1	7,039.8	30,130.9
Alabama	48,768.0	702.2	1,258.1	436.1	1,694.2
Florida	190,772.5	2,234.7	4,404.5	1,234.2	5,638.7
Georgia	681,240.1	8,383.2	16,551.6	5,049.7	21,601.3
South Carolina	32,675.5	467.7	876.9	319.8	1,196.7

TABLE 2.85
Public Health Costs—2000
(thousands of dollars)

Basin and purpose	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Savannah					
Solid waste	460.0	1,386.4	11.4	1,304.1	1,315.5
Georgia	--	721.6	--	721.6	721.6
South Carolina	460.0	664.8	11.4	582.5	593.9
Vector	--	272.1	--	272.1	272.1
Georgia	--	145.0	--	145.0	145.0
South Carolina	--	127.1	--	127.1	127.1
Air pollution and radiation monitoring	--	20.0	--	20.0	20.0
Georgia	--	10.0	--	10.0	10.0
South Carolina	--	10.0	--	10.0	10.0
Public health	460.0	1,678.5	11.4	1,596.2	1,607.6
Solid waste	460.0	1,386.4	11.4	1,304.1	1,315.5
Vector	--	272.1	--	272.1	272.1
Air pollution and radiation monitoring	--	20.0	--	20.0	20.0
Ogeechee					
Public health	--	412.1	--	412.1	412.1
Solid waste	--	256.1	--	256.1	256.1
Vector	--	151.0	--	151.0	151.0
Air pollution and radiation monitoring	--	5.0	--	5.0	5.0
Altamaha					
Public health	5,900.0	4,327.5	139.8	2,304.5	2,444.3
Solid waste	5,900.0	4,094.5	139.8	2,071.5	2,211.3
Vector	--	203.0	--	203.0	203.0
Air pollution and radiation monitoring	--	30.0	--	30.0	30.0
Satilla-St. Marys					
Solid waste	400.0	435.4	7.2	270.4	277.6
Florida	--	88.0	--	57.9	57.9
Georgia	400.0	347.4	7.2	212.5	219.7
Vector	--	221.0	--	221.0	221.0
Florida	--	35.0	--	35.0	35.0
Georgia	--	186.0	--	186.0	186.0
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0
Florida	--	4.0	--	4.0	4.0
Georgia	--	6.0	--	6.0	6.0
Public health	400.0	666.4	7.2	501.2	508.6
Solid waste	400.0	435.4	7.2	270.4	277.6
Vector	--	221.0	--	221.0	221.0
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0
Suwannee					
Solid waste	--	791.9	--	791.9	791.9
Florida	--	237.5	--	237.5	237.5
Georgia	--	554.4	--	554.4	554.4
Vector	--	203.6	--	203.6	203.6
Florida	--	119.6	--	119.6	119.6
Georgia	--	84.0	--	84.0	84.0
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0
Florida	--	5.0	--	5.0	5.0
Georgia	--	5.0	--	5.0	5.0
Public health	--	1,005.5	--	1,005.5	1,005.5
Solid waste	--	791.9	--	791.9	791.9
Vector	--	203.6	--	203.6	203.6
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0

(continued)

TABLE 2.85—Continued

Basin and purpose	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Ochlockonee					
Solid waste	--	339.5	--	209.5	209.5
Florida	--	210.0	--	131.1	131.1
Georgia	--	129.5	--	78.4	78.4
Vector	--	230.0	--	230.0	230.0
Florida	--	194.5	--	194.5	194.5
Georgia	--	35.5	--	35.5	35.5
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0
Florida	--	6.0	--	6.0	6.0
Georgia	--	4.0	--	4.0	4.0
Public health	--	579.5	--	449.5	449.5
Solid waste	--	339.5	--	209.5	209.5
Vector	--	230.0	--	230.0	230.0
Air pollution and radiation monitoring	--	10.0	--	10.0	10.0
Apalachicola-Chattahoochee-Flint					
Solid waste	9,398.8	7,265.2	229.6	4,604.1	4,833.7
Alabama	244.0	520.3	4.4	346.1	350.5
Florida	--	117.1	--	80.6	80.6
Georgia	9,154.8	6,627.8	225.2	4,177.4	4,402.6
Vector	--	364.5	--	364.5	364.5
Alabama	--	84.7	--	84.7	84.7
Florida	--	34.5	--	34.5	34.5
Georgia	--	245.3	--	245.3	245.3
Air pollution and radiation monitoring	--	45.0	--	45.0	45.0
Alabama	--	10.0	--	10.0	10.0
Florida	--	10.0	--	10.0	10.0
Georgia	--	25.0	--	25.0	25.0
Public health	9,398.8	7,674.7	229.6	5,013.6	5,243.2
Solid waste	9,398.8	7,265.2	229.6	4,604.1	4,833.7
Vector	--	364.5	--	364.5	364.5
Air pollution and radiation monitoring	--	45.0	--	45.0	45.0
Choctawhatchee-Perdido					
Solid waste	2,335.0	2,829.8	46.8	1,574.1	1,620.9
Alabama	--	686.0	--	483.1	483.1
Florida	2,335.0	2,143.8	46.8	1,091.0	1,137.8
Vector	--	366.0	--	366.0	366.0
Alabama	--	225.5	--	225.5	225.5
Florida	--	140.5	--	140.5	140.5
Air pollution and radiation monitoring	--	16.0	--	16.0	16.0
Alabama	--	8.0	--	8.0	8.0
Florida	--	8.0	--	8.0	8.0
Public health	2,335.0	3,211.8	46.8	1,956.1	2,002.9
Solid waste	2,335.0	2,829.8	46.8	1,574.1	1,620.9
Vector	--	366.0	--	366.0	366.0
Air pollution and radiation monitoring	--	16.0	--	16.0	16.0
Southeast River Basins					
Solid waste	18,493.8	17,398.8	434.8	11,081.7	11,516.5
Alabama	244.0	1,206.3	4.4	829.2	833.6
Florida	2,335.0	2,796.4	46.8	1,598.1	1,644.9
Georgia	15,454.8	12,731.3	372.2	8,071.9	8,444.1
South Carolina	460.0	664.8	11.4	582.5	593.9
Vector	--	2,011.2	--	2,011.2	2,011.2
Alabama	--	310.2	--	310.2	310.2
Florida	--	524.1	--	524.1	524.1
Georgia	--	1,049.8	--	1,049.8	1,049.8
South Carolina	--	127.1	--	127.1	127.1

(continued)

TABLE 2.85—Continued

Basin and purpose	Investment	OM&R at year 2000	Annual equivalent		
			Investment	OM&R	Total
Air pollution and radiation monitoring	—	146.0	—	146.0	146.0
Alabama	—	18.0	—	18.0	18.0
Florida	—	33.0	—	33.0	33.0
Georgia	—	85.0	—	85.0	85.0
South Carolina	—	10.0	—	10.0	10.0
Public health	18,493.8	19,556.0	434.8	13,238.9	13,673.7
Alabama	244.0	1,534.5	4.4	1,157.4	1,161.8
Florida	2,335.0	3,353.5	46.8	2,155.2	2,202.0
Georgia	15,454.8	13,866.1	372.2	9,206.7	9,578.9
South Carolina	460.0	801.9	11.4	719.6	731.0

Comprehensive Plan

Pollution abatement is a service-type activity whose objective is the protection of water quality for other uses. It is important in resource planning. The maintenance of stream water quality will permit an increase of growth and development. Each phase of the public health program is planned to supply a service needed for improvement of the environment. Such plans are comprehensive in nature and coordinated with all other functions for the protection of the public health, safety, and welfare.

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

Department of Health, Education and Welfare. *Technical Memoranda for Water Supply, Pollution Abatement, and Public Health*, Public Health Service, Region IV, Water Supply and Pollution Control Program, Atlanta, Georgia.

Arrays of data provided by States compiled by Public Health Service with development of single-purpose needs fitted to population projection by line item.

Savannah Basin	— January 1962
Ogeechee Basin	— November 1960
Altamaha Basin	— May 1962
Satilla-St. Marys-	
Nassau Basins	— December 1960
Suwannee Basin	— December 1960
Ochlockonee Basin	— May 1961
Apalachicola-	
Chattahoochee-	
Flint Basins	— March 1962
Choctawhatchee-	
Perdido Basins	— August 1961

Department of Health, Education and Welfare. *Water Quality Basic Data, Southeast River Basins*, Public Health Service, Region IV, 1961.

Compilation of available water quality data supplemented by data obtained in a limited stream study.

Other references used:

State Water Pollution Control Board. *Water Quality Criteria* (second printing), Sacramento, California, 1957.

Compendium of technical and legal literature pertaining to water quality criteria for various beneficial uses of water.

Federal Security Agency. *Southeast Drainage Basins*, Public Health Service, Division of W.P.C., Southeast Drainage Basins Office, 1951.

A cooperative State-Federal Report on water pollution. South Carolina Water Pollution Control Authority. *Eighth Annual Report*, July 1, 1956-June 30, 1957.

Stream classifications, studies, and water pollution surveys.

Supplemental Data

Selected documents referred to in the narrative on pollution abatement and public health follow. Other pertinent and more detailed data on these phases of public health are included in the files of the United States Study Commission, Southeast River Basins.

Accompanying documents are:

- (1) Criteria for Sewage and Industrial Waste Treatment Requirements.
- (2) Functional Work Plan for Pollution Abatement.
- (3) Outline for Presentation of Study Plans for the Southeast River Basins-Public Health
- (4) Instructions, Municipal Waste Inventory
- (5) Instructions, Industrial Water and Waste Inventory

In addition the following documents included as supplemental data to Part Two, Section VI—Water Supply, also apply equally to this Section.

- (1) Work Plan covering Terminal Studies for Comprehensive Resources Development and Utilization in the Southeast River Basins.
- (2) Criteria Establishing Raw (untreated) Water Quality Requirements.
- (3) Criteria for Planning to Meet the Future Municipal Water and Sewerage Needs.

CRITERIA FOR SEWAGE AND INDUSTRIAL WASTE TREATMENT REQUIREMENTS

Introduction

Paucity of information on receiving water characteristics, pollution loads and the uncertainties of projecting population growth and industrial development do not warrant detailed determination of treatment requirements for the studies being made. Treatment required can be determined by using such data as are available to the area as a whole and synthesizing general water quality required in the streams. Requirements for industrial waste treatment will be determined by considering their domestic waste equivalent.

Some types of wastes can not be expressed in domestic waste equivalents. Some do not lend themselves to conventional methods of treatment usually referred to as "Primary" and "Secondary." For example, the removal of toxic elements is the only treatment required for satisfactory handling of some wastes. The complexities of the various types of treatment process for their adequate handling of special wastes can not be spelled out in this study. Therefore, the terms used are meant to imply such treatment as is necessary to achieve the reduction of waste loading usually attributed to conventional primary or secondary treatment processes. Assumption is made that industry will not release inorganic or toxic materials with their liquid wastes in such quantities as to interfere with legitimate water uses and that treatment can and will be accomplished using sedimentation and oxidation principals. Treatment needs will be based upon the quality of water required for specified water uses.

Water Uses

The key water uses in the development of treatment needs are (1) esthetic enjoyment, (2) fish and aquatic life, and (3) public health uses. Water quality requirements for these three uses can be satisfactorily evaluated for our purpose by employing three quality parameters: (1) Floating, dissolved and settleable solids; (2) dissolved oxygen, and (3) coliform bacteria. Water quality for all downstream uses can be satisfactorily protected by some combination of primary and secondary treatment of wastes plus effluent disinfection and dilution water.

Water Quality Objectives for SERB Studies

- (1) Surface waters should not offend the sense of sight or smell.
- (2) All surface waters should permit normal growth of fish and aquatic life.
- (3) Surface waters intended for a source of municipal water supply, food processing water or water contact sports should be free from coliform bacteria attributable to sewage discharge.

Meeting Water Quality Objectives

(1) Full enjoyment of the esthetic qualities of a body of water will require, among other things, that settleable and floating solids, oils and unnatural color be removed from sewage and industrial wastes being discharged to the water body. Dilution alone cannot be depended upon to

disperse these solids, oils and colors to a point that they are not offensive to sight or smell. Therefore all sewage and industrial waste must receive at least primary treatment or its equivalent prior to discharge to surface waters.

(2) A factor which determines whether or not fish and aquatic life will live normally in waters receiving treated wastes is the oxygen concentration. The ratio of dilution water to waste will determine the degree of waste treatment required to maintain a suitable oxygen concentration. Waste treatment should be provided so that the oxygen concentration of the receiving water will not be reduced below 4 ppm. due to the introduction of treated wastes. For detailed planning of waste treatment works and dilution water management specific analyses and calculations are necessary. For the SERB studies a simplified procedure to determine dilution water requirements (and the degree of treatment) has been used. The following six stream situations have been studied and required dilution ratios at critical (high summer) temperatures formulated for primary and secondary treatment plant effluents. These ratios will be used in determining dilution and secondary treatment required.

Size of stream	Location	Dilution ratios — c.f.s./1,000 PE*	
		Primary effluent	Secondary effluent
Large	Coastal Plain	14.0	3.8
Medium	Coastal Plain	6.0	1.2
Small	Coastal Plain	2.4	0.3
Large	Piedmont	3.8	0.75
Medium	Piedmont	1.6	0.2
Small	Piedmont	1.1	0.1

* Population equivalent of untreated waste = 0.17 pounds (5-day 20°) BOD per capita daily.

(3) Protection of waters to be used for municipal water supply, food processing or water contact sports against bacterial contamination can be achieved by disinfecting treated waste effluents or by holding wastes in oxidation ponds for at least 30 days.

Methods of Determining Degree of Treatment Required

(1) The annual minimum seven-consecutive-day flow experienced once in 10 years will be computed from watershed areas and run-off curves to waste discharge points.

(2) The waste load at each discharge point will be computed in terms of population equivalent — Allowance of 35% load reduction will be made for primary treatment, 85% for conventional secondary treatment or for oxidation ponds.

(3) Dilution requirements for present and future waste loadings will be determined and compared with (1) above.

(4) Where dilution water is inadequate with primary treatment the dilution required after secondary treatment will be determined.

(5) Storage requirements to provide for dilution deficits will be obtained from generalized draft storage curves.

(6) The recommended treatment and/or supplemental storage will be derived from cost studies of the several

alternative methods of obtaining comparable results and selecting the cheapest. One alternative will be storage and regulated discharge of treated wastes.

(7) Disinfection of all sewage treatment plant effluents will be recommended when such effluents are discharged upstream to points where receiving waters are used for municipal water supply, food processing, shellfish production or water contact sports.

WORK PLAN - POLLUTION ABATEMENT

(edited to delete administrative details)

I. *Introduction* — P. L. 85-850 requires a coordinated and comprehensive plan for pollution abatement. For this study pollution is defined as the introduction into surface or ground waters, or any substance, solid, liquid or gaseous that interferes with use of these waters. The source of pollution may be (1) natural such as leaching or organic material from swamps or (2) may result from man's use of land such as erosion products from agricultural land or (3) from man's activity in the home and industry. The examination and planning for abatement of sediment from land use and abatement of naturally occurring salinity will be considered in functional work plans for Sediment Control and Salinity Control.

For this study pollution abatement is defined as water quality management which controls the source, treatment and discharge of sewage and industrial waste (and other harmful or objectionable material not classed as sediment and salinity) to surface and ground waters.

II. *Objective* — To evaluate existing pollution abatement efforts; and to determine measures necessary to prevent damages to legitimate water use by sewage and industrial wastes; and to formulate a plan for pollution abatement and control.

III. *Guidelines* — This study will be dynamic not static in nature. Its objective is essentially of a service and supporting character to protect water uses against unreasonable damage. Until all water needs and sources of pollution are determined, final plans for pollution abatement cannot be made except by empiricism. Therefore this outline will be subject to modifications that additional knowledge, resources, attitudes, positions and time dictate.

The principal sources of pollution are sewage and industrial waste. These are fixed in location and are subject to classical study. Other sources of pollution such as return irrigation flows, radioactive fallout, pipeline breaks, sewage from boats, tanker spills and washing of economic poisons into water have no fixed time or place of occurrence. They will be more difficult to evaluate and if warranted will be the subject of special studies.

The study will cover existing pollution sources, methods of treatment and in cooperation with other functional studies, determine the effect of pollution upon legitimate water uses, and predict water quality management requirements to meet needs in 1975 and 2000.

Functional studies of water uses that will be effected by pollution will include (1) domestic, municipal and

industrial water supply (2) fish and wildlife, (3) agricultural, (4) recreation, (5) navigation, and (6) hydropower. The dilution and transportation of liquid waste is a recognized water use.

All sewered communities and industries discharging waste daily through their own outlets will be considered individually. Estimates will not be made of smaller discharges unless the volume of receiving waters is small. Industries discharging to municipal sewerage systems will be included thereunder. The confidential nature of information on industrial wastes will require discretion in its collection and care in presentation to protect the givers of such information from disclosure.

Inventory information will be obtained from State or Federal Agencies supplemented where necessary by field information. A uniform reporting date for inventory data will be adopted. Reporting will be done on a physiographic basis in each river basin.

The study will determine water use below all significant waste outlets and record damages or interference with water use by pollution. Where possible dollar values will be obtained for damages found. Real but intangible damages such as offense to esthetic enjoyment will be reported.

In formulating plans for pollution abatement, account will be taken of minimum flow requirements for waste dilution purposes; administrative and regulatory practices; research; financing and such other matters as are pertinent to the subject.

Projections of future needs will be based primarily upon population and industrial projections which are being prepared by the Commission Economic Work Group.

IV. Work Outline

- A. Definitions and Criteria (Water quality standards, etc.)
- B. Technical Tasks
 1. Inventory sewage discharges (basic data)
 - a. Point of discharge
 - b. Population served (include significant industries)
 - c. Type treatment (efficiency)
 - d. Adequacy of treatment (age, capacity, desired results)
 - e. Quantity and quality of sewage effluents
 - f. Quality of receiving water (upstream)
 - g. Quality of receiving water (downstream)
 - h. Downstream receiving water uses
 - i. Interference with or damages to downstream water uses
 - j. Cost of treatment works (Capital & O & M)
 2. Inventory existing sewer systems (basic data)
 - a. Type
 - b. Population served
 - c. Adequacy
 - d. Cost — (Capital and O & M)
 3. Inventory industrial waste discharges (basic data)
 - a. Point of discharge
 - b. Type industry

- c. Production and/or employment figures
- d. Treatment
 - 1. Type
 - 2. Capacity
 - 3. Adequacy
 - 4. Cost
- e. Quantity and quality of waste discharged
- f. Quality of receiving water (upstream)
- g. Quality of receiving water (downstream)
- h. Downstream receiving water uses
- i. Interference with or damages to downstream water uses
- 4. Special Studies of pollution
- 5. Analysis of basic data
 - a. Develop "average costs" of sewers, sewage treatment and industrial waste treatment
 - b. Show existing needs in tabular form if existing treatment is inadequate
 - c. Other analyses and interpretations indicated as planning progresses
- 6. Compile projected water needs 1975 and 2000 (Coordinate with other functional studies) include both quantity and quality
- 7. On basis of (1) projected populations,* (2) projected industrial development* and (3) projected water needs prepare an estimate of sewer, sewage treatment and industrial waste treatment requirements for 1975 and 2000. (* From Economics Section Studies)
- 8. Estimate effect upon water quality if requirements under 6 above are not met.

C. Technical Programming

(Administrative details)

OUTLINE OF STUDY PLANS - PUBLIC HEALTH

- I. For 1960
 - 1. Summarize and discuss insect vector situation, unsolved problems and needs
 - 2. Make recommendations if necessary to increase, reorient or otherwise modify existing insect vector program by
 - a. Federal agencies
 - b. State
 - c. Local agencies and estimating costs and benefits of recommendations.
 - 3. Summarize and discuss air pollution, as it is effecting urban and industrial development; trends; and control programs
 - 4. Make recommendations if necessary to establish or modify control programs by Federal, State and local agencies
 - 5. Summarize radioactivity levels of land and water, giving source or probable source of radioactivity
 - 6. Discuss present radioactivity levels relation to health, water and land use
 - 7. Discussion trends in occurrence and control of radioactivity

- 8. Make recommendations for land and water resource development in areas where undesirable radioactivity levels are found
- 9. Summarize and discuss solid waste disposal practice as it may effect land reclamation and water pollution
- 10. Make recommendation for solid waste disposal program that would enhance land and water resource development giving costs and benefits
- II. For 1975
 - 1. Project vector control, air pollution, radioactivity and solid waste situation
 - 2. Project measures needed to control situations giving costs and benefits if possible
 - 3. Make recommendations for monitoring-research-control measures-and programs
- III. For 2000
 - 1. Project vector control, air pollution, radioactivity and solid waste situation
 - 2. Project control measures needed and costs if possible

WORKSHEET - MUNICIPAL WASTES INVENTORY¹

Definition

Municipal Wastes include all liquid wastes received by community sewers.

Semi-public wastes are those from schools, motels and other similar systems not included under municipal and industrial wastes.

Identification

Basin — USSC Basin Name.

State — Self explanatory.

County — Self explanatory.

Municipality — Name of city, town or community. If semi-public facility, give name, mailing address, distance and direction from center of nearest incorporated municipality.

1960 Population — From 1960 census, leave blank for semi-public facility.

Official contacted — Name.

Title — Official title.

Ownership — Place check mark on appropriate line, enter name if privately owned.

Type of semi-public facility — Type is to be determined according to major use of premises, i.e., hotel, store, hospital, school, etc.

Sewerage System

Type — Place check mark on appropriate line. Separate system is one receiving domestic and industrial wastes. Combined system is one receiving storm drainage in addition to domestic and industrial wastes.

¹ Information obtained was placed on an inventory sheet in accordance with the listed items shown here.

Population served — Number of persons served by system.
Sewage Volume:

Seasonal or 12 month average — Obtain the average daily flow in MGD for the past 12 months. If the system is operated only during certain seasons obtain average daily flow in MGD for the period of time operated.

Maximum day of record — Record flow in MGD for the maximum day of record during the past 12 months.
Seasonal variation:

Months — List month or months of maximum flow.

Percent — Record percent of average flows occurring during months listed in previous item.

Principal features of treatment — List by code symbols used in the PHS "Inventory of Municipal and Industrial Waste Facilities."

Design Capacity:

MGD — Smallest hydraulic capacity (most critical) of units listed in previous item.

PE (BOD)¹ — Smallest biological capacity (most critical) of units listed under "Principal feature of treatment."

Population equivalent (PE) will be determined by assuming a total of 6 persons contribute one pound BOD (5 day, 20°C) per day.

Estimated PE (BOD)²:

Raw — Number of persons who would contribute the same weight of BOD as that in the untreated sewage entering the system.

Discharged — Number of persons who would contribute the same weight of BOD as that being discharged from the system.

Receiving Waters

Water course — Name of first identifiable stream wastes enter after discharge from system.

Trib. to — Name of next stream wastes enters, after the one above.

Descriptive location of outfall — Give distance and direction from center of municipality, highway number or name, or street location.

Approximate stream miles — Give distance in miles from mouth of stream listed in "Water Course" item above.

Observed condition at outfall on date of survey — Record physical effects of discharged waste on the stream.

Downstream water uses — List uses of water of receiving streams below outfall. Examples: municipal water supply, navigation, recreation, etc.

List uses adversely affected — Of those uses listed in the previous item, list ones which are known or suspected to be adversely affected by the presence of wastes from the municipality.

Recorded cases of interference with downstream use — List those cases which have been recorded in writing.

Other wastes reaching water course. Describe — Record types of waste and how they enter the water course.

¹ Total daily weight of BOD in pounds of system = strength of sewage (BOD in ppm) × flow (MGD) × 8.34 lbs.

² PE = pounds of BOD (1) × 6.

Include any wastes originating within the municipal jurisdiction and reaching the stream other than through the sewerage system, i.e., garbage, trash, backwash from filters, chemicals, dead animals, solid industrial wastes, etc.

Present Needs

Collective system — Enter number of persons needing new or expanded collection system.

Treatment plant — Indicate the type (use same code as under "Principal features of treatment") and capacity in MGD for new or replacement treatment units needed for adequate wastes treatment.

Outfalls:

Length — Record feet of new outfall sewers needed.

Interceptors — Give length of needed interceptors and record population these would serve.

How would needs be financed? — Give financing methods that would be anticipated for the above improvements, i.e., general obligation, bonds, revenue bonds, etc.

Source of operating revenue — Record sources of money used to pay for operating expenses.

Surveyed by — Enter name or names of person obtaining this information.

Date — Enter date survey was made.

WORKSHEET — INDUSTRIAL WATER AND WASTE INVENTORY³

Introduction

Industrial water use and industrial waste are major considerations in planning studies. Without this basic information planning cannot proceed. The inventory contains the minimum information needed and consists of facts generally known to informed people in industry. Information in the inventory will be summarized so a particular industry cannot be identified in the final report of studies. If planning studies later indicate a need for deviation from this general rule, concurrence of the State pollution control agency will be obtained before deviation.

Identification

Basin — U. S. Study Commission basin name.

State — Self-evident.

County — Self-evident.

Industry — Name under which industry does business.

Type — Write out type of industry using waste classification group designation as given in "Inventory Municipal and Industrial Waste Facilities; notes regarding tabulations, appendix A."

Informant — Name of person interviewed.

Title — Official title of person interviewed.

Mailing address — Post office address of the industry.

³ Information obtained was placed on an inventory sheet in accordance with the listed items shown here.

Descriptive location — Describe the location of industry so a person not familiar with the plant can find it. Give the name of the nearest municipality, the distance in miles and direction plant is from the municipality and the name and route of the road leading to the plant.

Product — Give the major product or products made.

Normal production — State the amount of products made or processed per day and the units used to measure production. Example: tons of pulp and paper produced; number of cattle killed; pounds of milk processed; size and number of cases of canned goods processed; pounds of cotton processed; yards of goods woven, finished, dyed, printed; etc.

Plant Operation

Hours per week — The average and maximum hours per week that the plant operates.

Weeks per year — The average and maximum number of weeks per year that the plant operates.

Number of employees — The average and maximum number of employees on all shifts.

Seasonal Variations — State if plant has a seasonal operation such as a cannery which might operate only three or four months or if the plant has certain periods of the year when work slacks off or increases considerably over average operations. Name the months when the seasonal operation or change occurs.

Planned expansion, change in process, etc. — Indicate any expansion, process or operation changes, etc., that are planned which will make a major change in the amount and quality of water needed or the amount and type of waste discharged.

Water Supply

Source — Write in the name of the lake, reservoir, stream, etc., if it is a surface source. If it is an underground source indicate by "well," "2 wells," "3 wells," etc.

Treatment — List the treatment units in accordance with PHS treatment code as used in the "Inventory of Municipal Water Facilities."

Work Season or 12 months average MGD — Give the 12 month average water use in million gallons per day if industry operates 12 months per year. If it is a seasonal industry give the average water used in million gallons per day for the last complete work season.

Maximum MGD of Record — Give the amount of water used during the day of maximum demand during the 12 month period or last complete work season used for computing the average water use.

Problems (describe) — Describe any problems that the plant encounters due to deficiencies in source, water quality, treatment facilities, etc.

Possible alternate supply — Indicate where industry might get additional water if needed. If surface, give name of

lake, stream, or reservoir and approximate distance from plant.

Raw water characteristics — List the principal characteristics of raw water used.

Analyses available — Where analyses are available record frequency. For example: daily, monthly, etc.

Sanitary and Industrial Wastes

Total volume — Give total volume of all wastes discharged by the industry and state how this volume was estimated such as measured, estimated from water use, etc.

PE (BOD)¹ untreated — Give the 5 day 20°C BOD population equivalent of the total waste before treatment and state how the value was estimated.

Type of waste — Indicate whether waste is organic, inorganic or both by circling the proper word or words.

Waste characteristics — Such as acid, alkaline, inert solids, oily, metals, toxic, etc. Circle descriptive word(s) and write in other characteristics.

Treatment

Volume, and type of waste — Give the volume of waste discharged from each outfall and the type of the waste such as sanitary, process, cooling water, etc.

Processes — If no treatment is given, indicate by word "none." If waste is treated give the processes employed using the treatment code given in PHS "Inventory of Municipal and Industrial Waste Facilities."

Period of Discharge — Indicate if discharge is continuous, one hour a day, 2 hours a day, one day a week, etc.

% Reduction — State the percent reduction obtained by treatment in P.E. (BOD), solids, and other characteristics of the waste such as acid, toxic materials, etc. Name the other characteristics of the waste such as acid, toxic materials, etc. Name other characteristics reported on.

Needs — List treatment needs as enlargement, additions, new plant, replacement of plant, improved operation, connection to municipal system or none.

Receiving Stream

Describe the color, odor, turbidity, deposits, scum and other physical appearances of the stream below each outfall on day of plant visit.

Other Wastes Affecting Water Quality

Kind — List kinds of waste not listed above that may reach surface and underground water. These could be liquids and solids from trash dumps, lagoons, fly ash pits, oil sums, etc.

Amount — Estimate amount of material reaching water.

Disposition — Describe method of disposing of waste and deficiencies in the disposal method that permit wastes to reach basins water.

Effect — Describe the effect of this waste on water quality.

¹ Total daily weight of BOD of system = strength of sewage (BOD in ppm) × flow (MGD) × 8.34 lbs.

SECTION XVI — OTHER BENEFICIAL PURPOSES

Item number 12 of Public Law 85-850, "other beneficial and useful purposes," was used to

cover, in special circumstances, the following purposes: (1) Low-flow augmentation; (2) land

transportation and landfill; and (3) beach erosion control and hurricane protection.

Low-Flow Augmentation

Low-flow augmentation is recognized as a purpose to be considered in plan formulation. Low-flow augmentation is used only for the residual after benefits and associated costs have been identified with specific purposes such as navigation, recreation, fish and wildlife, pollution abatement, power, and the other purposes listed in Public Law 85-850. Benefits associated with low-flow augmentation costs were developed as a part of the overall evaluations of other purposes and were then deducted and transferred to low-flow augmentation for analysis. This insured that there could be no double counting of benefits. A further overall control adopted by the Commission was that no allocation of costs for low-flow augmentation as a separate purpose would exceed 15 percent of the total reservoir project cost.

In application of the Commission studies, low-flow augmentation was identified and used only in the Suwannee basin, where stream flows are particularly erratic. Average annual flows are relatively high but uncontrolled streams go dry during periods of low rainfall and thus become problems rather than assets.

Land Transportation and Landfill

Land transportation and landfill, not to be associated with sanitary landfill, were recognized as identified purposes of development plans only in the Ochlockonee basin. As part of the Gulf Coast Improvement project, spoil material from excavation and dredging would make possible land transportation along the coast. This would provide a favorable location for a new highway expected to be needed in this area in the near future.

The spoil material not needed for highway construction would be used to fill the adjoining swamplands. Spoil material would also be used to improve land in the Steinhatchee River Improvement project. In assigning benefits to landfill, only the increased value of land actually improved was considered in the monetary analyses. Enhancements of adjacent lands are expected to be an important factor but these were not evaluated in monetary terms.

Beach Erosion Control and Hurricane Protection

General Concept

Beach erosion control and hurricane protection are essential to the preservation and restoration of the shoreline to insure its optimum and sustained use.

The composition of practically all southeastern beaches is predominantly fine quartz sand. Along most beaches a rather delicate balance exists between the forces tending to erode the beach by carrying the sand away and the forces tending to replace the sand from other areas. Usually, both sets of forces — those of erosion and those of accretion — are present, and it is the difference between the two that determines whether a beach is eroding or building up. Currents, called littoral currents, running parallel to the shore frequently are a dominant feature in beach erosion and accretion. Tidal action also influences the characteristics of a given shoreline. The net effect of these forces might be pictured as a river of flowing sand whose direction and velocity are determined by the character of the forces impressed on it in the form of winds, waves, and currents.

There is good evidence that the aggregate effect of present shoreline modifications is a loss of land area. In some areas, land is being lost at average rates greater than 15 feet per year, while in other areas some land is being gained. Tides 15 feet higher than normal may be caused by persistent strong wind acting on the ocean surface. High tides and the resulting floods cause more than 75 percent of the loss of life from hurricanes. Hurricanes over the years have destroyed and damaged many miles of beach and have caused great loss of life and property.

The overall objective in a program for shore protection is to prevent destruction of the shoreline by erosion resulting from natural or man-made conditions and to prevent damages resulting from hurricanes. These objectives may be achieved by building structures, by removing some structures, or by preserving the equilibrium of the natural forces acting on most beaches.

Work Plan

A work plan was prepared for the work to be performed by cooperating agencies which was

essentially an inventory of present and potential problem areas and an appraisal of needs.

The inventory required a narrative and qualitative description of shoreline conditions and changes. Present conditions were obtained by a reconnaissance of the shore. A comparative analysis of maps and charts from the earliest to the latest surveys revealed changes. A fairly accurate picture can be obtained of erosion and accretion along most of the shore for the past 100 years.

The appraisal of needs is based on contemplated use by a greatly increased population, the rate of shoreline change, present and potential damage and effects, and other factors.

Work Performance and Coordination

The Beach Erosion Board, Corps of Engineers, U. S. Army, prepared a narrative type report through use of available data and firsthand knowledge and experience of Corps of Engineers personnel. The report, prepared by the Beach Erosion Board, included the following items:

- (1) Purpose of study;
- (2) area included;
- (3) scope of study;
- (4) state of current general conditions;
 - (a) resumé of shoreline changes and problems;
 - (b) resumé of existing improvements;
 - (c) resumé of Federal and other concerned agencies; authority, requirements, and methods for cooperation;
- (5) discussion of probable future requirements;
 - (a) general type and extent of remedial works;
- (6) feasibility of improvements for current and future needs;
- (7) long-range view — probable magnitude of future works;
 - (a) need for further study.

A section summarizing data on hurricanes in the study area was also included.

A report was made by the U. S. Geological Survey at the request of the Study Commission. This deals primarily with the long-term trends of shore movement. It interprets the various geomorphic signs of shore advance and shore retreat and supplements the report of the Beach

Erosion Board which covers more specifically changes measured during the past century.

Using the above reports as basic material, additional data was secured by the Commission staff by reconnaissance and research and collated for each of the eight basin appendixes.

Coordination was accomplished by direct liaison throughout the studies.

Findings

Accurate maps and charts are available for the shoreline. Early surveys were made of most of the coast over 100 years ago. In some places several surveys have been made since then. Beach erosion project studies have been made at four places. Hurricane studies have also been made for all the coastal areas.

Most reaches of shoreline in the Southeast River Basins reveal a complex of erosion and accretion. River mouths and inlets have migrated. Along the Atlantic coast most sea islands are being actively eroded at the present time on the north by southward migrating river channels. At the same time the islands are growing on the south side. The west coast of the Florida peninsula in the Southeast River Basins area is a tidal marsh, and the shore is, for most part, the muddy growing edge of the marsh. There are few sandy beaches there, and, where present, are thin and poorly developed. The shore of the Florida panhandle is characterized by large continually shifting sandbars offshore and several elongated barrier islands, spits, and hooks, all with highly mobile beaches.

Future population growth will result in a demand for development of presently unused coastal areas. Such development for recreational, residential, and industrial use will require stabilization measures for shore areas and inlets and protection of low areas from inundation and damage by hurricane-induced tides. As the need to use those areas reaches its ultimate limit, eventually all shores and inlets in the study area will probably be improved and stabilized. Most economic use of coastal resources necessitates coordinated planning for all uses. The two valid conclusions which may be reached at this time are that a thorough engineering study must be made before recommendations for construction are considered and that a complete economic analysis of projects must also be made.

Shore erosion problems are eligible for study by the Corps of Engineers in cooperation with local public agencies under authority of Public Law 520, 71st Congress. Local agencies may request such a study by application to the District Engineer for the district in which the problem area is located. Under a policy expressed in Public Law 826, 84th Congress, Federal aid for construction of shore protection measures may be recommended for publicly owned shores, or for privately owned shores if the protection will result in public benefits. Under authority of Public Law 874, 87th Congress, Federal contribution to the cost of protecting public shores is one-half of the first costs of the project, and in the case of fully developed public beach parks which meet certain criteria, Federal aid may be as much as 70 percent. No Federal aid may be recommended for maintenance of protection measures, but periodic nourishment is construed as construction eligible for Federal aid if it is the most suitable and economical remedial measure.

Projects recommended for Federal aid in construction of erosion control must be specifically authorized by Congress after study by the Beach Erosion Board prior to contribution of Federal funds therefor.

Studies of hurricane protection were authorized by Public Law 71, 84th Congress. Most of the hurricane protection problems in the study area have been studied under this authority. Further congressional authority will be required for additional hurricane studies after those being made under the original authorization have been completed.

Engineering studies and economic analyses can be made by State agencies such as the Coastal Engineering Laboratory of the Florida Engineering and Industrial Experiment Station, College of Engineering, University of Florida, Gainesville, Florida. Private consulting engineers can also perform this type of work.

Comprehensive Plan

The need for erosion control was apparent in the formulation of recreation plans. By rebuilding numerous beaches, recreation could be enhanced measurably. The establishment of beach erosion and hurricane controls in many instances create problems in sustaining fish and wildlife

resources. In formulating specific projects, it would be necessary to include criteria for the perpetuation of fish and wildlife resources and their associated habitats.

The recent advent of Federal assistance in hurricane protection has presented new opportunities for the development of coastal engineering criteria and has stimulated further research. Multiple-purpose planning in solving coastal problems is increasing. Such planning involves coordination and stabilization of navigation inlet channel improvement and maintenance and hurricane protection. Projects of this type are likely to develop in the future along the Atlantic and Gulf shores where barrier beaches are prevalent. A cooperative survey should be made to develop needs and solutions for these problems. The survey would consider influences of tides, offshore currents, hazards from hurricanes, winds, and places of immediate danger. The results of Corps of Engineers studies, which cover most of the hurricane protection problems in the study area, should be utilized.

The beach erosion plans developed should be coordinated with plans for channel improvement and maintenance, hurricane protection, recreation, fish and wildlife proposals, and other improvements proposed for the area.

The Weather Bureau is responsible for furnishing advance warning when a hurricane is approaching and is likely to reach a coastal area. The Weather Bureau also provides information on conditions expected to occur within the hurricane, such as wind speeds, abnormal hurricane tides, probability and extent of flooding, and other pertinent data about the storm.

Evacuation routes should be established over roads, bridges, and causeways. A community hurricane preparedness plan should be prepared by local authorities in cities and communities along the Gulf coast to minimize death and destruction.

Provisions should be made and adopted for establishing and enforcing zoning and building codes, establishing auxiliary power supplies and alternative communication systems, and constructing protective seawalls or similar structures.

An official State agency in Florida for shore preservation has been established with necessary provisions for State participation in erosion studies and in construction of protective works. This

State agency should be utilized to the utmost. A similar agency is desirable for the other States.

Bibliography

Prepared for the U. S. Study Commission, Southeast River Basins:

U. S. Department of the Army. *Beach Erosion and Hurricane Study of the Shores of Georgia and Portions of Florida*, Beach Erosion Board, Corps of Engineers, June 1961.

U. S. Geological Survey. *Shore-Erosion Study of the Coasts of Georgia and Northwest Florida*, Clifford A. Kaye, June 1961.

Other references used:

Literature listed in the bibliographies of *Beach Erosion*

and Hurricane Study of the Shores of Georgia and Portions of Florida, and Shore-Erosion Study of the Coasts of Georgia and Northwest Florida.

Shore and Beach, Journal of the American and Shore and Beach Preservation Association, Washington, D. C.

Shore Lines, Florida Shore and Beach Preservation Association, Tallahassee, Florida.

Numerous publications of the Coastal Engineering Laboratory, Florida Engineering and Industrial Experiment Station, College of Engineering, University of Florida, Gainesville, Florida.

National Hurricane Research Project Reports, prepared by the Weather Bureau in Collaboration with the Corps of Engineers, under Public Law 71, 84th Congress, 1st Session.

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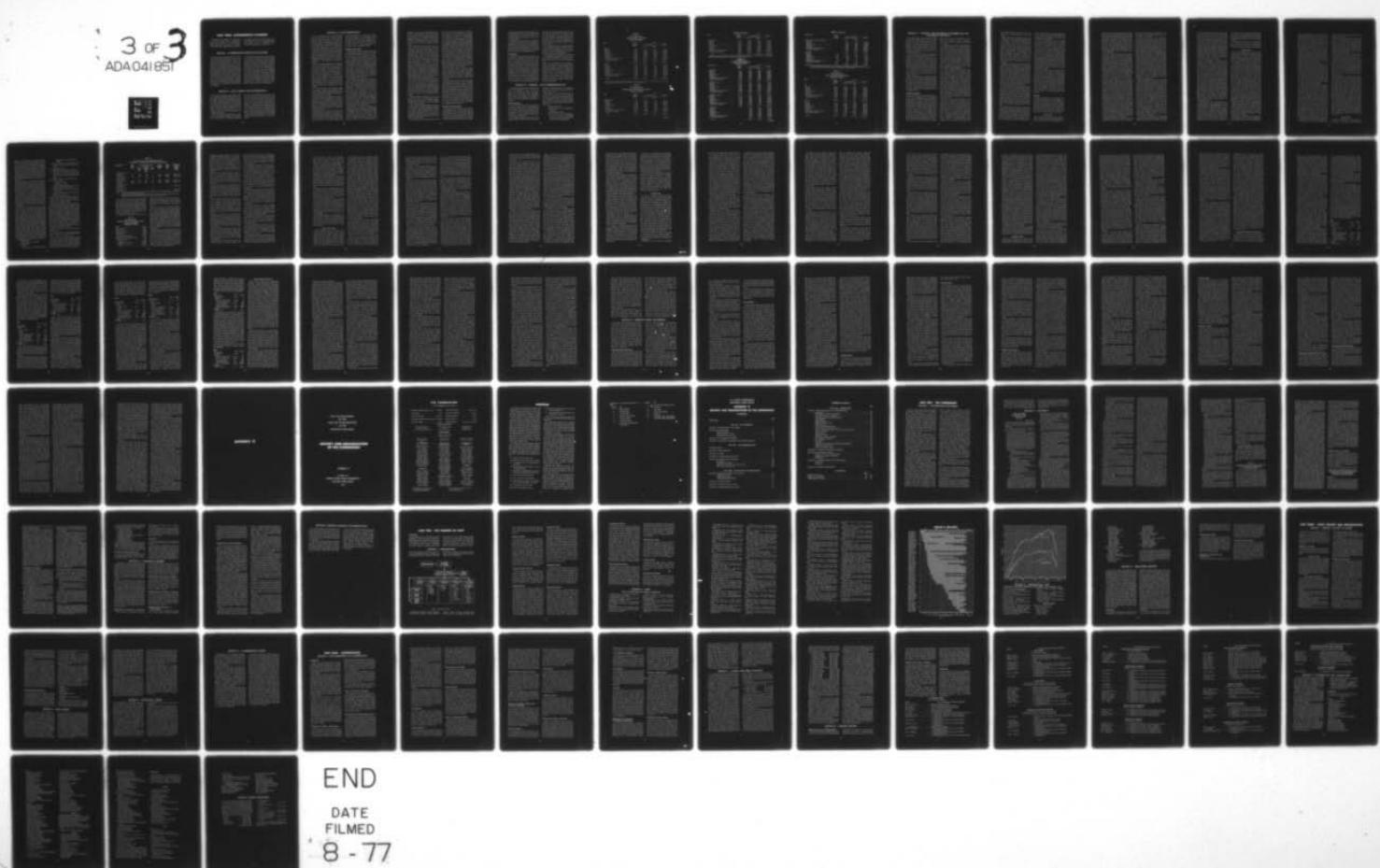
UNITED STATES STUDY COMMISSION SOUTHEAST RIVER BASINS--ETC F/G 8/6
PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOU--ETC(U)
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PART THREE - COMPREHENSIVE PLANNING

Comprehensive planning is the culmination of all other planning effort. Comprehensive planning is the fourth of the four fundamental planning steps discussed in Section I of Part One in this Appendix. Comprehensive planning is

not separate from the first three steps of the planning process, but rather it encompasses them and augments them to a significant degree through multiple-purpose considerations.

SECTION I - COMPREHENSIVE OBJECTIVE AND CONCEPT

The aim of the comprehensive plan is to provide for development, promotion, use, and conservation of the land and water resources consistent with the present and future needs of the people. Major considerations were: (1) To meet all needs with reasonably compatible measures, and (2) to meet them with economic efficiency. Assumptions guiding the plan and the projections dictated by them set magnitudes of needs to be satisfied and requirements of resource development to meet the needs. For many of the needs, satisfaction could best be attained through new land and water developments to supplement both existing projects and continuing programs. Some of the needs could best be obtained by expansion or intensifying existing projects and programs.

Multiple-purpose developments hold the greatest prospect of efficiently reconciling conflicts between purposes. Generally, resource planning recognizes the need to anticipate the future requirements of land and water which are essential to growth and welfare. The economic aspects of the planning task have been emphasized, particularly as they relate to the scale, sequence, and timing of development plans. Considerable attention has been given to the impact of land and water development on community and area growth. The Commission plan has been formulated using both tangible and intangible factors. Purely economic considerations have been fully recognized but have been tempered by social, legal, and other institutional considerations.

SECTION II - DATA SOURCES AND COORDINATION

Data for developing the comprehensive plan were obtained from published and other existing sources, special field investigations, and office studies. Views of local interests were gathered at a series of public hearings and presentations of tentative plans and by direct and continuing liaison with local residents, organizations, and agencies. Data developed through the three categories of studies — basic, functional, and area or basin — were all essential for preparation of a comprehensive plan.

Contact with interested individuals and agencies was maintained throughout the planning process. Both formal and informal discussions

were held with individuals and groups of residents in various parts of their basins. Not only were the local people informed of general progress but, in turn, useful views and expressions of local desires were obtained. Likely sources of support or opposition to plan proposals were noted. More formal advice was obtained through the medium of special advisory groups and committees which discussed and criticized proposals prior to their incorporation in the plan. These advisory and steering groups had a membership of Federal and State professionals in the studied fields of resource development, use, and conservation.

SECTION III – PLAN FORMULATION

The most important and complex problem faced in comprehensive plan evolution was the problem of weaving together into one balanced plan the means of satisfying the needs related to the 12 purposes studied. Single-purpose ways of meeting needs were available for each purpose in all basins. Basin needs were estimated for each purpose considering the overall area needs.

Following the general guidelines established and within the philosophy of plan formulation stated in Part Three, Section III of the Commission Report, needs were examined and single-purpose possibilities viewed with the objective of finding compatible combinations and resource capabilities to satisfy needs in a harmonious manner.

To meet the general objective of maximizing net returns and satisfactions from the resources to be developed by the plan, each increment of the plan was designed to provide benefits at least equal to the cost of that segment or increment with full consideration of intangible values. Plans were formulated as far as possible so that (1) total benefits exceeded total costs, (2) each separable segment or purpose provided benefits at least equal to its cost, (3) the scale of development was such as to provide the maximum net benefits, and (4) there were no more economical means of accomplishing the same purposes.

The planning process was generally started by selecting a specific initial proposal. This nucleus proposal usually represented a project or program which seemed to offer promise of meeting a major objective or goal.

After the nucleus of development was selected for analysis and found justified on the basis of benefits and costs, consideration was given to scales of development that were greater or smaller than the selected nucleus. Variations in the scope of each separable increment were made and tested and the possibility of additions or omissions examined.

By the process of elimination, the most promising combination of projects and programs was identified and tested. By this fitting process, in which the segments yielding fewer benefits than costs are dropped, and those segments producing more benefits than costs grouped together, sub-

stantial modifications were made in the initial plan. In this process, it was common for plans previously discarded by resource agencies to be accepted as the result of new combinations on a broader base for formulation. This process continued until the best combination was evolved to meet the established needs.

Multiple-Purpose Plans

Information developed in single-purpose studies and the special needs of the area as reflected in the projected needs of the eight basins were the initial bases for development of a comprehensive multiple-purpose plan. Planning was oriented largely to basin needs, but as each basin study progressed, the resources and needs of adjoining basins were considered in an effort to seek mutual solutions to common problems. Thus, step by step, interbasin relationships were recognized to a degree greater than the interrelationships incorporated in the estimates of needs. When the basin plans were completed, some adjustments were made to assure appropriately uniform treatment of similar resource situations throughout the study area.

The programs and projects which served as nuclei for the initial planning varied greatly from basin to basin because of the character of the resources, the nature of the needs, and the nature of the land and water projects already established or planned. Proposals leading to initial plans or to additions or subtractions from plans being tested came from diverse sources. Residents throughout the area and local development organizations expressed interests in projects of many kinds and suggested combinations of resource use and development which they believed would meet particular needs. Federal agencies and State agencies also were the source of much information on possible projects and project combinations.

Consideration was given to complementary land and water uses. Following the development of single-purpose ways for meeting needs, studies of compatible resource uses and areas of potential conflict in resource use were made. It was found that needs for forestry, recreation, and fish and wildlife frequently could be met by proper utilization of the same land resource.

Similarly, water resource development plans could serve acceptably the purposes of flood control, hydroelectric power, water supply storage, fishing, and recreation, although operating adjustments had to be considered so that the most favorable multiple-purpose operating arrangements could be assured to maximize overall net benefits.

When sufficient preliminary study had been made to determine for each basin a potential combination of programs and projects, a series of detailed studies were made with the aid of consultants and agencies in specialized fields. With this help, a series of tests were begun in which the objective was to choose from among the alternatives those filling the needs most effectively. In this process, the problem of deciding among competing uses sometimes arose and there was present always the need to seek arrangements whereby the greatest play of complementary values would occur. This process involved a series of adjustments, in varying degrees of refinement, combined with progressively refined economic, hydrologic, and engineering comparisons until the best combination of proposed developments was evolved. This process was all within reconnaissance limitations.

Many of the needs could best be met by large water storages. The lack of large storages was noted as a resource deficiency for in-place use, for water supply, and for flow regulation in several of the functional studies. Existing developments were reviewed first to see what expansion and improvement measures could be employed to satisfy portions of total needs. This done, attention was turned to new development possibilities.

Numerous possible storage sites were screened both in the field and by map study until the possibilities were reduced to a workable number of what appeared to be the best sites for meeting portions of overall needs.

At this point in the planning process, the aid of other agencies was again sought. Work plans were prepared and study agreements reached toward more detailed examination of each site to determine the capacity of a site for accommodating a combination of features serving more obvious purposes. These studies were often identified as terminal studies.

The work plans for so-called terminal studies

were arranged in seven sections: (1) Resource needs; (2) work to be performed; (3) scope; (4) guidelines and criteria; (5) study details; (6) submission of results; and (7) duration; each of which in general language set forth what the Commission required of the participant and how the participant should proceed. The technical supplements to these work plans provided details. Briefly, supplements included: The present and future needs in quantitative terms to be satisfied for each of the purposes enumerated in the authorizing Act; the kind and scope of studies for specifically identified sites and areas; and the guidelines and physical and economic criteria pertinent to the types of studies requested.

As used by the Commission, these terminal studies served as advanced stepping stones for further evaluations, allocations of costs, and other refinements of the plan. However, because they were precluded by the authorizing Act, detailed final analyses were not made.

After the initial reports of terminal studies became available, some of the lists of possible storage developments were further reduced. In some instances the new group was returned to the interested agency for restudy to determine if a still more efficient satisfaction of needs would be possible.

When what appeared to be the best grouping of multiple-purpose storages was set, the individual projects were further examined to determine if purposes other than the basic ones also could be accommodated. As the water storage project plans became firm, both as physically and economically feasible, and the inclusion of features for the several purposes found to be economically sound, other multiple-purpose facilities such as water access areas, largely for recreation and fish and wildlife, were examined. In a few cases, it was found that this type of development, being more efficient, could be substituted for multiple-purpose reservoirs.

Treatment of Alternatives

The comparison of alternatives is the heart of the planning process. It is necessary both to understand the nature of projects and programs rejected and the reasons for rejection, as well as the character of those accepted in the plan, and to understand the role played by the various tests to which each segment of the plan was subject.

Many proposals were rejected early in the analysis and without the necessity for detailed study if reconnaissance studies showed them to be clearly uneconomical. Many projects of this kind were encountered.

Although many of the problems and considerations were common to all areas, the differences introduced by nonuniform resources distribution and local resources characteristics called for some special considerations in preparation of the basin plan. These special considerations are included in Part Three of the Commission Report.

Coordination

Coordination in the Commission work involves three separate, although deeply interrelated, categories: (1) Coordination of parts of a study, (2) coordination of results of separate studies, and (3) coordination of elements of the plan. Coordination of studies has been described elsewhere in this Appendix as well as in other Appendix volumes. This category of coordination is concerned with identifying subjects or segments of subjects to be investigated. The segments are all essential parts of a unit. For example, the overall studies were defined as explained earlier into the four steps of: (1) Gathering inventory data of resources and existing developments; (2) estimating needs and projecting them to the

year 2000; (3) comparing single-purpose ways of meeting the needs with the resources; and (4) combining the ways of meeting the needs into a comprehensive integrated plan. One co-ordination device was that of preparing work plans for each of the purposes listed in the Act. These work plans are covered in Part Two of this Appendix.

The coordination of results of separate studies was accomplished through a number of devices. Perhaps the most important device was that of selecting common denominator terms such as user-days for all types of recreation.

The coordination of elements of the plan was to a large degree accomplished by the selection of formulation guides that were common to the eight basin areas and to the overall Commission plan.

Beside the coordination devices referred to above, a specific effort to attain coordination was through the medium of advisory groups. The tentative comprehensive plan for each basin was presented to the Land, Water, and Economics Groups members for critical review and comment; also, the overall Commission plan was reviewed by these groups. The comments and suggestions from these advisors helped significantly to make the plan complete and the parts mutually supporting.

SECTION IV – FINDINGS – THE COMPREHENSIVE PLAN

The comprehensive plan is the culmination of all of the Commission studies. As the focal point of the planning activities, the comprehensive plan is the theme of the Commission Report as well as the theme of the appropriate portion of the comprehensive plan by basins in each of the basin appendixes—Appendices 1 through 8.

Plan Presentation

Plans can be described by narrative, by graphic art, and by tabular data or by combinations of these methods. Maps, charts, tables, and narrative are used in the Commission Report and in the appendixes to present the plan. Where benefits and costs are used to describe the plan, they are expressed in 1960 dollars.

The Commission Report presents the plan by purposes listed in Public Law 85-850; by plan

features for the complete study area; by basins; and by States. Each of the basin appendixes follows the same pattern.

Many other ways of presenting the plan are possible other than those used in the Commission Report and Appendixes 1 through 8. Preference of individual readers and special uses are some of the main reasons for alternative tabular summaries of the dollar benefits and costs. The tables are by:

- Programs and Projects
- Multiple-Purpose and Single-Purpose Elements
- Land and Water Features
- Special Categories (food and fiber, leisure time, storage and streamflow, water supply, pollution abatement and public health, and navigation)

TABLE 3.1
Comprehensive Plan
Summary—Programs and Projects
(thousands of dollars)

Basin	Benefits*	Costs			
		Annual equivalent	Total	OM&R	Investment
Programs					¢
Savannah	37,150	35,849	25,115	437,802	
Ogeechee	15,953	10,423	6,607	136,412	
Altamaha	45,285	30,916	18,103	475,434	
Satilla-St. Marys	33,020	15,380	9,905	191,821	
Suwannee	28,067	16,986	10,788	222,192	
Ochlockonee	16,369	12,133	7,221	181,055	
Apalachicola-Chattahoochee-Flint	63,633	71,483	42,101	1,152,880	
Choctawhatchee-Perdido	40,930	36,454	23,291	548,727	
Total	280,407	229,624	143,131	3,346,323	
Projects					
Savannah	61,718	45,539	8,013	776,510	
Ogeechee	5,140	1,553	643	26,710	
Altamaha	25,136	17,937	3,649	317,390	
Satilla-St. Marys	4,432	2,496	1,121	36,220	
Suwannee	6,980	3,507	1,307	61,474	
Ochlockonee	10,028	6,289	1,500	133,429	
Apalachicola-Chattahoochee-Flint	54,432	39,181	7,702	758,550	
Choctawhatchee-Perdido	12,034	7,259	3,790	83,376	
Total	179,900	123,761	27,725	2,193,659	

* Benefits of single-purpose pollution abatement, water supplies, and public health programs assumed to be at least equal to costs. Annual benefit of \$11,410,000 for multiple-purpose projects were evaluated but are not included in this table.

TABLE 3.2
Comprehensive Plan
Multiple-Purpose and Single-Purpose Elements
(thousands of dollars)

Basin	Benefits*	Costs			
		Annual equivalent	Total	OM&R	Investment
Multiple purpose					
Savannah	65,691	46,728	8,449	797,250	
Ogeechee	9,274	2,686	1,297	39,947	
Altamaha	27,479	18,963	4,032	334,870	
Satilla-St. Marys	10,259	3,041	1,224	50,740	
Suwannee	10,906	4,810	1,936	80,174	
Ochlockonee	13,439	7,511	2,079	151,149	
Apalachicola-Chattahoochee-Flint	66,502	42,600	9,464	804,850	
Choctawhatchee-Perdido	12,963	5,282	2,071	80,252	
Total	216,513	131,621	30,552	2,339,232	

(continued)

TABLE 3.2—Continued

Basin	Benefits*		Costs	
	Annual equivalent	Annual equivalent		Investment
		Total	OM&R	
Single purpose				
Savannah	33,177	34,660	23,679	417,062
Ogeechee	11,819	9,290	5,953	123,175
Altamaha	42,942	29,890	17,720	457,954
Satilla-St. Marys	27,193	14,835	9,802	177,301
Suwannee	24,141	15,683	10,159	203,492
Ochlockonee	12,958	10,911	6,641	163,335
Apalachicola-Chattahoochee-Flint	51,563	68,064	40,339	1,106,580
Choctawhatchee-Perdido	40,001	38,431	25,010	551,851
Total	243,794	221,764	139,303	3,200,750

* Benefits of single-purpose pollution abatement, water supplies, and public health programs assumed to be at least equal to costs. Annual benefit of \$11,410,000 for multiple-purpose projects were evaluated but are not included in this table.

TABLE 3.3
Comprehensive Plan
Summary by Special Categories
(thousands of dollars)

Basin and category	Benefits		Costs	
	Annual equivalent	Annual equivalent		Investment
		Total	OM&R	
Food and fiber ¹				
Savannah	9,411	6,875	3,755	116,872
Ogeechee	7,805	4,260	2,966	47,859
Altamaha	17,727	8,758	4,941	139,304
Satilla-St. Marys	8,609	4,470	2,861	60,616
Suwannee	17,589	8,370	5,167	116,922
Ochlockonee	7,726	4,988	2,885	78,704
Apalachicola-Chattahoochee-Flint	15,028	11,247	6,004	190,890
Choctawhatchee-Perdido	12,705	7,305	4,009	127,616
Total	96,600	56,273	32,588	878,783
Leisure-time activities ¹				
Savannah	19,237	8,466	6,157	90,410
Ogeechee	7,874	3,448	2,096	41,496
Altamaha	28,103	9,042	6,057	96,583
Satilla-St. Marys	21,517	5,761	3,598	72,625
Suwannee	9,930	4,447	3,174	38,675
Ochlockonee	7,933	2,756	1,799	31,351
Apalachicola-Chattahoochee-Flint	48,004	17,092	11,591	178,940
Choctawhatchee-Perdido	31,354	10,644	7,071	138,681
Total	173,952	61,656	41,543	688,761
Storage and streamflow				
Savannah	58,440	42,842	6,064	741,410
Ogeechee	5,414	1,689	669	29,747
Altamaha	23,351	17,469	3,225	315,857
Satilla-St. Marys	6,260	2,010	577	40,110
Suwannee	7,517	3,576	1,230	65,459
Ochlockonee	10,337	6,588	1,518	140,979
Apalachicola-Chattahoochee-Flint	55,033	39,595	7,458	774,400
Choctawhatchee-Perdido	5,008	2,833	623	52,416
Total	171,360	116,602	21,364	2,160,378
Water supply ^{1,2}				
Savannah	--	8,968	6,156	122,100
Ogeechee	--	1,410	987	16,770
Altamaha	--	5,055	3,476	64,150
Satilla-St. Marys	--	3,265	2,592	22,500
Suwannee	--	1,696	1,138	22,440
Ochlockonee	--	2,460	1,805	27,200
Apalachicola-Chattahoochee-Flint	--	25,500	17,450	362,600
Choctawhatchee-Perdido	--	12,340	9,682	118,700
Total	--	60,694	43,286	756,460

(continued)

TABLE 3.3—Continued

Basin and category	Benefits		Costs	
	Annual equivalent	Annual equivalent		Investment
		Total	OM&R	
Pollution abatement and public health ¹				
Savannah	—	5,457	2,676	111,140
Ogeechee	—	1,169	532	27,250
Altamaha	—	7,677	3,831	158,800
Satilla-St. Marys	—	1,182	687	21,300
Suwannee	—	2,395	1,379	40,100
Ochlockonee	—	1,382	669	30,550
Apalachicola-Chattahoochee-Flint	—	17,230	7,300	404,600
Choctawhatchee-Perdido	—	7,330	3,176	178,200
Total	—	43,822	20,250	971,940
Navigation ¹				
Savannah	11,780	8,780	7,320	32,380
Ogeechee	0	0	0	0
Altamaha	1,240	852	222	18,130
Satilla-St. Marys	1,066	1,188	711	10,890
Suwannee	11	9	7	70
Ochlockonee	401	248	44	5,700
Apalachicola-Chattahoochee-Flint	0	0	0	0
Choctawhatchee-Perdido	3,897	3,261	2,520	16,490
Total	18,395	14,338	10,824	83,660

NOTES: ¹ Projects involving multiple-purpose storage reservoirs not included as data are included in storage and streamflow category.
² Benefits of single-purpose pollution abatement, water supplies, and public health programs assumed to be at least equal to costs. Annual benefits of \$11,410,000 for multiple-purpose projects were evaluated but are not included in this table.

TABLE 3.4
Comprehensive Plan
Summary of Land and Water Features
(thousands of dollars)

Basin	Benefits		Costs	
	Annual equivalent	Annual equivalent		Investment
		Total	OM&R	
Land				
Savannah	45,426	20,239	12,065	293,772
Ogeechee	20,912	9,307	5,714	117,095
Altamaha	56,718	22,869	12,800	330,284
Satilla-St. Marys	34,441	11,799	6,945	163,581
Suwannee	32,839	15,404	9,322	200,574
Ochlockonee	24,681	13,456	6,054	230,625
Apalachicola-Chattahoochee-Flint	76,287	33,311	19,311	464,780
Choctawhatchee-Perdido	47,385	19,358	11,524	293,607
Total	338,689	145,743	83,735	2,094,318
Water				
Savannah	53,442	61,148	20,067	920,540
Ogeechee	181	2,669	1,536	46,027
Altamaha	13,703	25,984	8,952	462,540
Satilla-St. Marys	3,011	6,078	4,081	64,460
Suwannee	2,208	5,089	2,775	83,092
Ochlockonee	1,716	4,966	2,657	83,859
Apalachicola-Chattahoochee-Flint	41,778	77,353	30,495	1,446,650
Choctawhatchee-Perdido	5,579	24,355	15,557	338,496
Total	121,618	207,642	86,120	3,445,664

SECTION V - PROJECTS AND PROGRAMS CONSIDERED BUT NOT INCLUDED IN THE PLAN

The studies leading to the comprehensive plan for the Southeast River Basins area as a whole and for each of the eight basins involved consideration of numerous projects that were not ultimately selected and included in the plan. Some of the more significant projects that were eliminated during plan formulation and brief reasons for their exclusion are summarized in the basin appendixes.

Many of the features that were eliminated from consideration for development before the year 2000 may be needed soon after that year. In most instances, projects and programs were adopted or excluded on the basis of rough and preliminary data. Accordingly, some units included in the plan may prove to be infeasible when detailed studies are made. Conversely, some of the units that were not selected may prove to be acceptable means of meeting needs when more refined studies are made, particularly if items included in the current plan are subsequently eliminated.

Most of the program-type activities were considered on an areawide basis. Basin boundaries generally do not represent any definitive change in program activities but merely provide lines for subdividing the overall programs into segments that can be related to other basin activities. The same general procedures were used for all basins in studying and selecting portions of the program items.

Areawide Programs

The agricultural and forestry programs selected for the comprehensive plan are believed to be the most practicable means of obtaining needed produce, using all of the land that is expected to be available for agricultural production. Maximum production is not required from all the lands to meet production needs and it was necessary to select programs from several alternative type measures. For example, there are several million acres of land suitable for irrigation in the Southeast River Basins. Most of the land could be provided with an adequate irrigation water supply. Studies showed, however, that production from irrigating all of the irrigable land would far exceed production require-

ments. The same situation resulted, to a lesser degree, when drainage, intensive fertilization, and other methods of maximizing production were studied.

The possibilities of extensive land conversions were briefly considered. It was found, however, that land use in the area is generally adapted to the type of land available, and the cost of major conversions and the related disparity in management levels would not appear to justify such a course. In addition to the cost-returns relations, such a program would involve the tremendous institutional problems of changing a pattern of operation that is performing on a reasonably satisfactory basis. Thus, arbitrary land conversions were minimized in favor of the adopted plan of improving management levels as necessary to meet agricultural demands.

The effects of using commercial timber areas for recreation, hunting, and limited grazing were investigated. It was concluded that intensively used recreation areas generally cannot be used for wood production. Intensive wildlife management generally requires favoring hardwoods, many of which have little commercial value. Extensive management is compatible with timber production but intensive wildlife management may require measures that would reduce timber production from the areas proposed for dual use. Controlled seasonal grazing is compatible with most softwood timber production but is detrimental to hardwoods. Fencing and other grazing control measures were included in the plan to restrict uncontrolled use of timber areas for grazing.

Flooding is comparatively common in the study area, but damages are comparatively small. Flood plain land use has been limited by the flood hazard. If land was needed for agricultural production, protecting flood plain areas so that the land could be used intensively would be highly desirable. Flood control was not often found feasible as a single-purpose undertaking. It was also provided wherever warranted as a part of multiple-purpose development. Flood plain management, including zoning, is suggested as a means of avoiding flood losses, recognizing that at some time in the distant future

the marginal value of land may alter the conclusion that maximum protection is not warranted.

Wells are generally recommended as the source of supply for domestic, municipal, and industrial water needs in areas where adequate ground water supplies are known to be available. The fact that surface water sources were not proposed as a major source of supply should not be construed to mean that there is no foreseeable need for surface supplies. The ground water supply is tremendous, but not inexhaustible, and extensive pumping will most certainly create drawdown cones of significant proportions in many areas. Many surface water sources not included in the plan because they are not currently needed may be vitally important after the year 2000.

Navigation studies were generally limited to possibilities for development within individual basins. A broader possibility that was suggested to the Commission and briefly considered was an inland system that would interconnect the Tennessee Valley Authority, Coosa River, Chattahoochee River, and Savannah River systems to form an interior route for barges that would directly connect the inland system to the Atlantic Ocean, as well as provide alternative routes to the Gulf of Mexico. The system would be tremendously expensive and would not be justified for the traffic load estimated for the next 40 years.

Nuclear-powered electric generating plants may eventually replace presently used types of generation. If nuclear generation becomes more economical, or more useful, than other means, it can be substituted for planned facilities. Pumped storage was studied rather thoroughly at several potential sites in the study area. While pumped storage was not considered feasible under present conditions, the need for pumped storage developments should be considered from time to time. Attractive opportunities are available.

The Southeast has tremendous opportunities for both fish and wildlife and general recreation enhancement. Almost innumerable combinations of developments could be devised to meet projected needs. The advantages of providing opportunity within reasonable travel distance of all parts of the basins, and of providing an area-wide environment that would be helpful in at-

tracting industrial and other developments into the area which would provide employment and personal income were major factors considered in planning for these activities.

The effects of programs, especially drainage and timber-stand improvement, on wildlife values were analyzed. Drainage was found to be detrimental to wildlife because it eliminated natural feeding areas for waterfowl. However, the amount of drainage anticipated in the adopted plan is not considered to be of a magnitude that would seriously affect the wildlife program, and no restrictions were applied merely for the sake of maintaining wildlife habitat. Timber-stand improvement need not harm the wildlife habitat if some hardwoods and den trees are maintained, and if timbered areas are interspersed with small cleared areas. It was assumed that these practices would be followed to a reasonable degree, and no restrictions were imposed on the forestry program.

Pollution abatement and the protection of public health were assigned monetary values where necessary for allocation of multiple-purpose costs. Generally, however, it was assumed that maintenance of public health is an absolute essential if any degree of economic stability and prosperity is to prevail. Under this assumption, the value of the needed facilities is limited only by the alternative cost of reaching the desired ends by the cheapest possible means. This is not to say that monetary values do not accrue—it merely admits that no satisfactory means has been established for evaluating human health and life.

Projects

Numerous potential sites for multiple water and land use developments exist throughout the Southeast River Basins area. The projects included in the comprehensive plan are described in detail in Appendixes 1 through 8. Projects considered but not included are also briefly described in these same appendixes. Some of the more significant projects that were not included in the plans are discussed more fully below.

Savannah Basin

Brier Creek—The reservoir site is located on Brier Creek in Richmond and Jefferson Counties, Georgia, upstream from the U. S. Highway No. 1

crossing. The proposed dam normally would store water to elevation 300 feet and have a maximum level of 305 feet during flood periods. The normal pool area would total 4,600 acres. Fish and wildlife, regulation of downstream flows, recreation, and a minor amount of flood control could be served. The dam and reservoir would cost an estimated \$5,068,000 and would be an alternative to improvements along Brier Creek using several smaller water-regulating structures. It was dropped from further consideration after a field examination.

Long Cane—The reservoir site is located on Long Cane Creek near Abbeville and Greenwood, South Carolina. The reservoir would have a 3,000-acre surface area at elevation 400 feet and would be for recreation, fish and wildlife, and incidental purposes. The cost of the dam and reservoir is estimated at \$6,467,000. As a result of a field inspection, it was decided that further consideration of this project was not justified at this time because of its proximity to Clark Hill Reservoir, even though it would form an attractive recreation area for Abbeville and Greenwood and the counties of McCormick, Abbeville, and Greenwood, South Carolina.

Toxaway—The project site is on Toxaway River in South Carolina. A dam at this site was considered which would back water into North Carolina on Horsepasture and Toxaway Rivers. The reservoir at elevation 1,200 feet would have an area of about 1,650 acres and would provide a gross power head of 280 feet. Water could be released from the Toxaway site to the small Jocassee site at elevation 920 feet. The Toxaway dam, reservoir, and powerplant would cost about \$63 million. The low Jocassee dam, reservoir at elevation 920 feet, and powerplant would cost about \$30.5 million. By raising the Jocassee site from 920 feet to 1,100 feet, the Toxaway site would be eliminated, and the cost of the larger Jocassee site would then be about \$45 million. The power capacity and energy production of the single-large Jocassee site would equal or exceed the combined capacity and energy production at the small Jocassee and Toxaway sites and would be less costly. Accordingly, the large Jocassee site was adopted in the plan of development and the Toxaway site was eliminated.

Numerous other sites on Toxaway River were studied, but most of them would involve expen-

sive dams and small reservoirs. However, in future studies, the potential developments in the area should be considered.

Whitewater River—Two sites on Whitewater River and several variations of plans at the sites were studied. The Upper Whitewater site, above Whitewater Falls in Jackson and Transylvania Counties, North Carolina, could create a power head of 800 to 1,000 feet. Estimated costs range from \$13,233,000 to \$42,206,000, and the estimated installed capacity of the powerplant considered ranged from 16,600 to 35,000 kilowatts. Much greater variation in installed capacity could occur if pump storage was considered. The recreation value of the Upper Whitewater Falls would be affected by diversion of water through a tunnel, penstock, and powerplant. North Carolina, South Carolina, and the U. S. Forest Service have partially developed the scenic recreation potential at the falls. The two States have constructed a road to the falls which has been hard-surfaced in South Carolina, but which has only been gravelled in North Carolina. It is evident that the falls are a scenic attraction; and since single-purpose power is marginal, further consideration of power development has been dropped at the upper site.

The Lower Whitewater Falls site is in Oconee County, South Carolina. A dam at this site would back water partly into North Carolina. It would operate at elevation 2,000 feet and would have gross heads ranging from 900 to 1,080 feet, depending on the elevation at the downstream Jocassee site on Keowee River. A small reservoir, about 116 acres in area and 11,000 acre-feet in capacity would regulate flow from the Whitewater River for installed power capacities ranging from 22,000 to 43,000 kilowatts. The estimated costs of the installation ranged from \$14,490,000 to \$16,759,000. Data on recreation were not available, but the consensus was that development of the Lower Whitewater Falls would be detrimental for recreation. The site was excluded from the plan of development because of the marginal value of power, and because of the possible interference to recreation. When future studies are made, however, this site should be reconsidered.

Chattooga River—There are several potential alternative sites on Chattooga River above the approved War Woman site. Studies were made

at two general locations, with variations of both head and capacity. The first site, called Chattooga No. 1, is located in Macon and Jackson Counties, North Carolina. The reservoir would be at elevation 2,600 feet and would have a gross power head of either 400 or 960 feet, depending on whether the lower Chattooga No. 2 site was in or out of the plan. The cost estimates range from \$16,452,000 to \$25,538,000, and the installed capacity ranges from 25,000 to 45,000 kilowatts. Fish and wildlife and recreation enthusiasts, who prefer maintenance of an open river, objected to this upper site. The high head unit of 960 feet (2,600-1,640) appears to be better justified than the low head unit of 400 feet but both were dropped from further consideration.

The lower Chattooga No. 2 site is in Oconee County, South Carolina, and Rabun County, Georgia. It has a gross head of 560 feet and would discharge into the approved War Woman site. The upper site operated at 400 feet would allow this site to be operated at the full potential, since the entire flow would pass through the lower site. However, if the upper Chattooga No. 1 were operated at the gross head of 960 feet, the lower Chattooga No. 2 site would have only about one-half of the water but would incur most of the cost. Accordingly, comparisons indicate that either the high head Chattooga No. 1 site, or the 560-foot lower site, without the upper site, would be the better possible alternatives. The lower site is objected to by recreation and fishing enthusiasts. It was dropped from the plan of development. Recreation and fish and wildlife development along an open Chattooga River, as part of the Upper Savannah project, is deemed to be a better alternative development in the reach of Chattooga No. 1 and No. 2 sites. Future studies, however, should reconsider development in this area.

Miscellaneous diversions—Alternative uses of water by diversion from existing Lake Toxaway in North Carolina to Horsepasture River, from Thompson River to Whitewater River, as well as others, were considered. These diversions would bolster or concentrate power potentials. In the case of the diversion from Lake Toxaway to Horsepasture River, the scenic value of Toxaway Falls would be affected. This possibility was discussed with one of the Lake Toxaway development owners who objected to the diversion.

Accordingly, this was dropped from the plan in accord with the principle of protecting an established water right, although the doctrine of prior appropriation apparently is not now dominant in the area.

In the case of the alternative use of Thompson River water to bolster power potentials on Whitewater River, or vice versa, the quantities of water appear to be too small for costs involved.

Ogeechee Basin

New areas and facilities are needed to accommodate the growing demands for fishing in large impoundments. Dam and reservoir projects which offered the opportunity for meeting the needs of sport fishing as well as recreation, hydroelectric power, flood control, water supply, and other purposes were considered at some 15 sites.

For the Mayfield site, studies for power, recreation, fishing, and other purposes indicated that a reservoir of the size required to serve multiple use would take too long to fill and would be uncertain in operation. A dam could be constructed here to create a reservoir of about 100 feet maximum depth with a surface area of some 25 square miles. A smaller reservoir, which would have been acceptable from the physical standpoint, would not economically meet the needs for sport fishing, low-flow augmentation, recreation, or hydroelectric power. The smaller reservoir would have a maximum depth of some 30 to 50 feet, with a surface area of about 200 acres, and a capacity of some 3,000 acre-feet of storage.

Preliminary studies of the Avera site and the Duhart Creek site for storage and diversion of water to the Louisville-C site for fishing, recreation, low-flow augmentation, and other purposes indicated lack of physical feasibility, and were dropped from further consideration. The diversion channel would be about 11 miles long and require cuts in the 50- to 100-foot range in depth.

Preliminary studies of the Louisville-B site for fishing, recreation, low-flow augmentation, and other purposes indicated costs in excess of benefits. A dam at this site would create a reservoir of some 40 feet maximum depth, with surface area of about 3,500 acres, and capacity of some 65,000 acre-feet of storage.

In an effort to identify potential hydroelectric power peaking capacity, as well as provide storage for fishing, recreation, and low-flow augmen-

tation, the Louisville-A site was investigated. A dam at this site would create a reservoir of about 100 feet maximum depth, with surface area of some 27,000 acres, and capacity of about 1.3 million acre-feet of storage. Cost estimates of the dam and reservoir alone would exceed \$22 million. While the development at this site would just about pay for the power facilities, the remaining benefits would cover only a small part of the storage costs. For other purposes, the costs exceeded the benefits. Another consideration in the elimination of this site from further consideration was its proximity to Clark Hill and Sinclair Reservoirs in adjacent basins. Should economic conditions change and the specific purpose needs be greater, this site appears to warrant further consideration at that time.

Preliminary studies of the Louisville-C site for fishing, recreation, and low-flow regulation for fishing and dilution water for pollution abatement indicated both physical limitations and lack of economic justification. A dam at this site would create a reservoir of some 50 feet maximum depth, with surface area of about 3,400 acres, and capacity of some 75,000 acre-feet storage. Normal rainfall and runoff would provide for filling of the reservoir over a period of about 1½ years. Cost estimates of the dam and reservoir alone would exceed \$2.2 million.

Studies were made of the Captolo and Ellabell sites for fishing, recreation, low-flow augmentation, and other purposes. A dam at the Captolo site would create a reservoir of about 40 feet maximum depth, with surface area of about 6,700 acres, and capacity of some 75,000 acre-feet storage. Investment costs for the dam and reservoir and facilities for fishing and recreation approach \$6 million. A dam at the Ellabell site would create a reservoir of some 30 feet maximum depth, with surface area of about 500 acres, and capacity of some 3,000 acre-feet storage. Investment costs for the dam and reservoir and facilities for fishing and recreation would be about \$800,000. However, when plans for adjacent basins were completed, it was found that essentially the same needs could be met more economically in the other basins, so these sites were eliminated from the Ogeechee basin plan.

Preliminary field studies of the Register site for fishing and recreation indicated elimination

because of existing small impoundments in the proposed reservoir area.

The Claxton site was eliminated in favor of the site near Groveland due to more favorable shoreline, other physical factors including reservoir size and depth, and picking up another tributary stream with a sizeable drainage area.

Field reconnaissance study for fishing and recreation eliminated the Spring Creek site because watershed conditions created unusual and difficult problems of management.

Field reconnaissance study of the Fort Stewart site for fishing and recreation indicated elimination due to inadequate depth in the reservoir.

Another means considered to meet the needs for fishing and water-based recreation involved public access sites to both fresh and salt water. Forty sites were considered for recreation use and 29 sites were considered for use by fishermen. By adjusting the location and arranging the development of access sites to serve both interests, it was found that the total number of sites could be reduced to 34, 10 of which would provide access to salt water.

Preliminary studies were made of the Bland and Sand Hill sites on Mill Creek for dilution water storage to meet estimated pollution abatement needs of Statesboro. A dam at the Bland site would create a reservoir of about 15 feet maximum depth, with surface area of some 280 acres, and capacity of about 2,500 acre-feet of storage. Delivery of this water to the vicinity of Statesboro would require a diversion channel over 35 miles long with maximum cuts of approximately 25 to 30 feet. A dam at the Sand Hill site would create a reservoir of about 10 feet maximum depth, with surface area of some 50 acres, and capacity of about 2,200 acre-feet of storage. While delivery distance is less than 1 mile, the estimated difference in elevation between storage and delivery point is approximately 95 feet. The distances involved from the Bland site and the lift requirements of the Sand Hill site indicate high costs. The alternative of tertiary treatment of the effluent would prove more economical and efficient and is included in the plan.

Altamaha Basin

Navigation—Three different proposals were investigated for providing a 9-foot navigation

project to Macon, but none offered sufficient benefits to warrant inclusion in the plan at this time. The first plan investigated consisted of seven low-lift locks and dams on the Ocmulgee River and high-lift locks and dams at the Abbeville, Coopers Ferry, and Ohoopee sites. Power facilities were provided at the three high-lift dams. This plan required 10,000 cubic feet per second regulated flow below the Ohoopee site, providing for navigation only 62 percent of the time and limiting the water use for peak power generation.

The second plan of improvement considered includes locks and dams at the same location as the first plan with an additional dam at Goose Creek. The power facilities and the lock for the Ohoopee dam would be moved downstream to the Goose Creek site. A canal with a bottom width of 110 feet and a minimum depth of 20 feet would divert water stored in the Ohoopee reservoir to the Goose Creek reservoir. The canal would also serve as a navigation canal. A regulated flow of 10,000 cubic feet per second would still be required below Goose Creek. The installed capacity for power would be increased in this plan due to the increased head available at Goose Creek.

The third plan investigated included the same system of dams and canals as the second plan plus two low-lift locks and dams below Goose Creek. This plan has the best benefit-to-cost ratio considering power and navigation only, and, therefore, is the one used in the navigation plan of development described hereafter. This plan of improvement is providing a 9-foot navigation channel on the Altamaha and Ocmulgee Rivers between the Atlantic Intracoastal Waterway and Macon. Below mile 64.5, the channel would be achieved by constructing two low-lift locks and dams. Above mile 64.5 the channel would be achieved by constructing three high-lift and seven low-lift locks and dams. The 9-foot channel was assumed to have the following characteristics which were used in designing the locks and dams and other required features, and in preparing the cost estimates for the study:

- a. Channel depth:
9 feet, plus 1-foot overdepth
- b. Channel width:
90 feet
Side slopes 2 on 1 for protected banks

- Side slopes 5 on 1 for unprotected banks
- c. Length of waterway between Atlantic Intracoastal Waterway and Macon: 246.6 miles
- d. Number of locks: 12
- e. Controlling radius on bends: 600 feet
- f. Design tow: 53 feet wide by 315 feet long, composed of two barges abreast (195 feet by 26 feet) plus a towboat 120 feet long
- g. Lock size: 60 feet wide, 360 feet long
- h. Depth over sills:
 - Upper sill — 18 feet
 - Lower sill — 14 feet
- i. Minimum bridge clearances: 40 feet vertically and 60 feet horizontally
- j. Minimum flow: Slack water from Macon to tidal water
- k. Freeboard at locks and dams: 5 feet above upper pool elevation

Table 3.5 lists data pertaining to locks and dams which are included in this 9-foot project.

Table 3.6 lists mileages based on slack water from tidewater to Macon, Georgia.

Relocation requirements for the various projects were estimated from field inspection of the reservoir areas, data on hand in the files, and from data assembled from U. S. Coast and Geodetic Survey maps and Georgia county maps. Heights of bridges were determined by measurement from bridge deck to flood plain and water level. The principal relocation cost involved was for roads and bridges while lesser costs were included for power transmission lines, telephone lines, and cemeteries. The cost estimate summary presents a single item for relocations at each of the reservoirs considered based on the principle of replacement in kind.

Project cost estimates were based on the following criteria:

- (1) Unit prices for dam quantities were based on actual contract costs for items of like nature on jobs in the general area.
- (2) Unit cost per acre for reservoir clearing were based on cost for clearing Hartwell Reservoir with probable increase due to nature of clearing operation in the proposed reservoir areas. Reservoir areas for clearing are based on area at the normal pool elevation plus 2 feet.

TABLE 3.5
**Pertinent Data on Locks and Dams for 9-Foot
 Navigation on the Altamaha and Ocmulgee Rivers, Georgia**

Development	Miles above mouth ¹	Elevation above mean sea level			Gross length of spillway (ft.)	Total length dam (ft.)	No. and size of spillway Height × length (ft.)
		Top of dam (ft.)	Maximum flood pool (ft.)	Lift (ft.) ²			
Altamaha River							
Ohopee	96	100	94.5	—	1,448	24,205	30-28 x 40
Goose Creek	66	100	94.5	65	232	3,000	5-25 x 40
Ocmulgee River							
Coopers Ferry	29.6	170	165	57	761	14,620	15-32 x 43
Abbeville	100.7	235	230	61	682	23,400	14-35 x 41
7 Low lifts, locks and dams ³	—	—	—	—	11	—	3-12 x 60
2 Low lifts, locks and dams ⁴	—	—	—	—	11	—	3-12 x 60

NOTES: ¹ Zero mile on the Altamaha River is at Buttermilk Sound. Zero mile on the Ocmulgee River is at The Forks.

² All lock chambers are 60 feet by 360 feet.

³ Dams to be located on the Ocmulgee at miles 12.6, 89.5, 160, 168, 177, 185, and 192. Average lift is 11 feet.

⁴ Dams to be located on the Altamaha at miles 28.7 and 39.5. Average lift is 11 feet.

(3) Unit cost per acre for land acquisition was obtained from a recent estimate of acquisition cost for a reservoir in the same general area and of comparable type land. The per acre costs include all costs involved in acquisition. Adjustment was made for observed differences in type of land to be acquired. Land acquisition was based on acquiring in fee the reservoir area to spillway design flood elevation.

A summary of cost estimates of first costs for

the project are shown in Table 3.6. Further preliminary studies indicated that the total benefits from power, navigation, recreation, and fish and wildlife were not sufficient to justify the project.

Dams and reservoirs — Many dam and reservoir sites were considered in the study. Some of these sites were considered as individual projects. For example, the navigation project previously discussed included the Goose Creek, Ohopee, Coopers Ferry, and Abbeville sites. While the project which included these sites could not be warranted, nevertheless, the four sites are included in the comprehensive plan for development for the purposes of power, recreation, and fish and wildlife. Some of the other pertinent sites not included in the plan are discussed briefly below.

Daniel Shoals project would include a dam about 70 feet high on South River and a reservoir with an area of 3,400 acres at normal full pool. The project was not studied in detail because of the probable high cost for its construction, due to the many improvements in the reservoir area. The reservoir site was near Atlanta and Decatur and the reservoir would be subject to pollution. The project was proposed for recreation and fish and wildlife use.

TABLE 3.6
Investment Costs—
Altamaha River – 9-Foot Project to Macon
Navigation and Power
(thousands of dollars)

Item	Cost
Goose Creek site	53,661
Ohopee site	23,372
Coopers Ferry site	36,961
Abbeville site	40,750
9 Low-lift locks and dams	57,067
Channel and curve improvement	2,778
Navigation markers	114
Subtotal	214,703
Contingencies (20 percent)	42,941
Total	257,644

Snapping Shoals site, proposed as a recreation and fish and wildlife project, is on the Ocmulgee River in Newton and Henry Counties, Georgia. The project site is downstream from the Peachstone site which was considered a better site. In the event physical difficulties, now unforeseen, should arise at the Peachstone site, further consideration should be given to the possible development of the alternative Snapping Shoals site.

McKay Creek site is on South River about 10 miles south of Porterdale, Georgia. A dam at this site would intercept drainage from 540 square miles. This site is considered inferior to the Peachstone site and was not studied in detail. It was proposed for recreation and fish and wildlife use.

The Almon damssite is on Yellow River in Gwinnett County, Georgia, about 3.5 miles west of Covington, Georgia. The drainage area above the damssite is 378 square miles. Preliminary studies showed that the proposed dam and reservoir could not be justified as there are better alternative sites for recreation and fish and wildlife.

Alcovy damssite for the proposed Alcovy project is on Alcovy River about 5 miles northeast of Covington, Georgia. The proposed project is estimated to cost \$4,400,000. The dam would be about 54 feet high and the reservoir area at normal full pool would have an area of 4,700 acres. The project could not be justified economically for recreation and fish and wildlife use.

The Factory Shoals site is on Alcovy River downstream from the Alcovy site and would include a dam about 60 feet high and a reservoir of 3,000 acres at normal full pool. Construction costs would be high. It was considered for recreation and fish and wildlife use, and was dropped from detailed study because there are better alternative sites.

The Lee Shoals damssite is on Yellow River about 10 miles south of Porterdale, Georgia. The drainage area above the damssite is 446 square miles. A reservoir at this site would flood Porterdale and, therefore, its costs would be high. There are better alternative sites for recreation and wildlife use.

The India damssite for the India project is on Apalachee River near Monroe, Georgia. The

drainage area above the damssite is 123 square miles, and the estimated project cost is \$2,600,000. The reservoir area at normal full pool would be 1,200 acres. This site is too costly for recreation and fish and wildlife development and could not be justified.

The High Shoals damssite is on the Apalachee River upstream of Highway No. 186. The project was proposed for recreation, fish and wildlife, and flood control. The estimated cost of the project is \$3,300,000 and the reservoir area at normal full pool would be 600 acres. The project could not be economically justified.

The Upper Athens damssite is on the Apalachee River near Monroe, Georgia. The project was proposed for recreation and fish and wildlife use. At normal full pool elevation the reservoir would have an area of 1,200 acres. This site is not as good as the New Bethel and Big Flat Creek sites.

The East Monticello damssite is on Shoal Creek about 15 miles southeast of Covington, Georgia. The reservoir normal full pool would have an area of 3,000 acres. The drainage area above the damssite is 25 square miles. The project was proposed for water supply, recreation, and fish and wildlife. The site could not be justified but it is a good alternative site for possible future consideration.

Lamar Ferry damssite is on the Ocmulgee River about 4 miles east of Flovilla, Georgia. The drainage area above the damssite is 1,500 square miles. Preliminary studies showed that there are better sites which could be developed for recreation and fish and wildlife.

The Dames Ferry damssite is on the Ocmulgee River about 10 miles below the Lamar Ferry site. The drainage area above the damssite is 2,090 square miles. Development of the site appeared not feasible.

The Big Indian project would have a drainage area of 623 square miles. It was considered for development for fish and wildlife use. The estimated project cost is \$6,900,000. The Abbeville site is a better one, and the alternative Big Indian site is not needed.

The Hawkinsville damssite is on the Ocmulgee River about 2 miles north of Hawkinsville, Georgia. The project was proposed for development for hydroelectric power, recreation, and fish and wildlife. At normal full pool elevation the reser-

voir area would be 15,500 acres. Preliminary studies showed that the reservoir would flood part of Warner Robins Air Force Base and, therefore, its construction is not practicable. The estimated cost of the project is \$280,782,000.

Dixons Landing project site is on the Oconee River about 40 miles below Dublin, Georgia. It was considered for development for hydroelectric power, recreation, and fish and wildlife. Preliminary studies indicated that this proposal could not be economically justified.

The Cypress Branch damsite is on the Oconee River about 10 miles downstream of the Dixons Landing damsite. The project was proposed for hydroelectric power development, recreation, and fish and wildlife. Preliminary studies indicated that this project could not be economically justified.

Tallassee damsite is on Middle Oconee River near Athens, Georgia. A dam about 55 feet high and a reservoir with an area of 2,100 acres was proposed for recreation and fish and wildlife use. This project would not be as good as the alternative Curry Creek project.

The Sandy Creek damsite is on the Ocmulgee River about 2 miles above the confluence of the Towliga and Ocmulgee Rivers. The project was considered for recreation and fish and wildlife use. The dam would be about 55 feet high and the reservoir area would be 2,100 acres at normal full pool. The reservoir would flood out a long stretch of the Southern Railroad and could not be justified.

Irwin Bridge damsite is on Yellow River just above Milstead, Georgia. It was considered for water supply, recreation, and fish and wildlife. The reservoir area would be 2,500 acres at normal full pool. There were many improvements in the reservoir site and the project is too high for justification.

Satilla-St. Marys Basins

Multiple-purpose dams and reservoirs — Dam and reservoir projects offer new areas for recreational and fish and wildlife activities, development of hydroelectric power, and low streamflow augmentation for pollution abatement. Opportunities for such developments in the Satilla-St. Marys basins were considered and 24 sites were studied. The sites considered were: (1) Burnt Fort on the Satilla River about 10 miles north-

east of Folkston, Georgia; (2) Hurricane Creek on the Alabaha River about 10 miles southeast of Blackshear, Georgia; (3) Waycross on the Satilla River about 6 miles northwest of Waycross, Georgia; (4) Pearson on the Satilla River about 7½ miles northeast of Pearson, Georgia; (5) Satilla-St. Marys across the Satilla and St. Marys Rivers about 6 miles northeast of Folkston, Georgia; (6) Macclenny on the St. Marys River about 5 miles north of Macclenny, Florida; (7) Little Hurricane Creek in Bacon County, Georgia; (8) Alabaha River in Pierce County, Georgia; (9) Upper Hurricane Creek in Jeff Davis County, Georgia; (10) Big Satilla Creek about 6 miles north of Patterson, Georgia; (11) Little Satilla Creek about 7½ miles southeast of Jesup, Georgia; (12) Spanish Creek, lower site, about 3 miles west of Folkston, Georgia; (13) Spanish Creek, Bethel Church site, about 4 miles northwest of Folkston, Georgia; (14) Mays Bluff Branch in Charlton County, Georgia; (15) Buffalo Creek in Pierce County, Georgia; (16) Little Buffalo Creek in Pierce County, Georgia; (17) Nassau River Embayment in Nassau and Duval Counties, Florida; (18) St. George on the St. Marys River about 2 miles southeast of St. George, Georgia; (19) Douglas on the Satilla River 5 miles southwest of Douglas, Georgia; (20) Broxton Creek about 5 miles south of Douglas, Georgia; (21) Seventeen Mile Creek about 5 miles east of Douglas, Georgia; (22) Thomas Creek near the Jacksonville, Florida, Penal Farm; (23) Upper Thomas Creek in Nassau and Duval Counties, Florida; and (24) Axson on the Satilla River about 3 miles northeast of Axson, Georgia.

The locations of these sites were determined by an examination of prior reports and existing maps and by field reconnaissances of the basins area. Of the 24 sites studied, 5, (9) Upper Hurricane Creek, (10) Big Satilla Creek, (17) Nassau River Embayment, (20) Broxton Creek, and (24) Axson, are included in the comprehensive plan of development for the Satilla-St. Marys basins and they will not be discussed here.

Sites (1) to (6), inclusive, were previously studied by Federal agencies for possible use for hydroelectric power development and flood control. All of these sites, except the (6) Macclenny site, were eliminated as preliminary studies indicated that they could not be justified econom-

ically. The studies involved utilizing previous studies of other agencies. Prices for costs and benefits and quantities were adjusted so that they represented 1960 prices and present-day conditions at the site.

Burnt Fort — The proposed Burnt Fort project included a dam, reservoir, and powerplant. The reservoir area and capacity at normal full pool were 75,000 acres and 1,790,000 acre-feet, respectively. The proposed hydroelectric powerplant had an installed capacity of 14,300 kilowatts and an output of 38,600,000 kilowatt-hours annually.

The site could not be economically justified. Also, it is in a flat area and the large reservoir drawdown of 10 feet would produce large mudflats around the reservoirs which would reduce its value for recreation. The reservoir would destroy reaches of stream fishing. Furthermore, reservoirs in the upstream reaches are more desirable as they could be used to augment low flows. The estimated project cost is \$50,200,000 and the power facilities estimated cost is \$11,140,000. The estimated annual project cost and annual power benefits are \$1,541,000 and \$622,000, respectively.

Hurricane Creek — This proposed project included a dam, a reservoir with an area of 21,800 acres and a capacity of 284,000 acre-feet at normal full pool, and a hydroelectric powerplant with an installed capacity of 4,100 kilowatts and an output of 14,700,000 kilowatt-hours annually. The estimated project cost is \$15,475,000 which includes the power cost of \$6,110,000. The estimated annual cost and annual benefits for power are \$605,000 and \$152,000, respectively. The power benefits would not justify the costs of the power facilities and the site is too costly to be developed for other purposes.

Waycross — The project included a dam, a reservoir, with an area of 23,700 acres and a capacity of 316,000 acre-feet at normal full pool, and a hydroelectric powerplant with an installed capacity of 3,700 kilowatts and an annual output of 10,900,000 kilowatt-hours. The estimated project cost is \$14,067,000 which includes a cost of \$4,632,000 for power facilities. The project annual costs are estimated at \$451,000 and the annual power benefits at \$209,000. More desirable reservoir sites are farther upstream.

Pearson — This proposed project on the Satilla River included a dam, a reservoir with an area of 3,650 acres and a capacity of 44,000 acre-feet at normal full pool, a hydroelectric powerplant with an installed capacity of 1,200 kilowatts and an annual output of 4,700,000 kilowatt-hours. The estimated project cost is \$7,761,000 which includes \$2,604,000 for power facilities. The annual project cost and annual power benefits are \$335,000 and \$116,000, respectively. This project is inferior to the proposed project at the Axson site.

Satilla-St. Marys project — The Satilla-St. Marys project would include a long dam across the St. Marys and Satilla Rivers and intervening area, a reservoir with an area of 152,000 acres and a capacity of 3,700,000 acre-feet at normal full pool and a powerplant with an installed capacity of 100,000 kilowatts and an annual output of 133,000,000 kilowatt-hours.

The estimated project cost and annual cost are \$67,958,000 and \$3,568,000, respectively. The estimated annual power benefit of \$1,848,000 is larger than the annual costs of \$1,600,000 for power. This project would have a maximum drawdown of 13 feet, which would produce a long distance in this flat country between the upper and lower limits of the shoreline. The reservoir is considered larger than needed for recreation and fishing as it is located too near the Atlantic coast, and the mudflats would detract from its recreation use. Reaches of streams valuable for fishing would be destroyed. The project appears infeasible economically and not practicable.

Macclenny and St. George — The Macclenny site was considered in several ways for multiple-purpose use. The elevation of the normal full pool was limited to elevation 105 feet. A pool higher than this would extend into the Okefenokee Swamp and affect this wildlife refuge. At elevation 105, the maximum height of the normal full pool above the streambed at the damsite is 65 feet. The value of a dam and reservoir for the production of hydroelectric power is proportional to the flow of the stream and the height of its fall. The value of a reservoir for recreation depends on the value of the shoreline and adjacent area for recreation as well as the value of the reservoir pool for recreation. A widely fluctuating pool detracts from its use

for recreation. Fish and wildlife benefits accrue from the reservoir and from the storage which is utilized to regulate the low flows downstream of the dam.

For a full pool elevation of 105 feet at the Macclenny site, the reservoir would have a surface area of about 26,000 acres and a storage capacity of 520,000 acre-feet. In this proposal, the maximum amount of peak power would be generated during the months of December, January, and February, the period of greatest demand for peak power in northern Florida and when the reservoir would have the least use for recreation, fishing, and hunting. Thereafter, the reservoir would be filled and operated primarily for recreation and fish and wildlife use. Flows resulting from small fluctuations in the pool elevations and the use of the natural flow of the river would permit the generation of some power during this period. The project would have an installed capacity of 37,000 kilowatts, and it would furnish annually about 23 million kilowatt-hours of energy. The project cost and annual cost were \$40,400,000 and \$2,277,000, respectively. Annual benefits from hydroelectric power amounting to \$1,069,000 would pay for its power facilities and only \$10,000 above that towards the dam and reservoir costs. The project would have a potential far greater than the projected needs for recreation and fish and wildlife. However, a dam and reservoir of this large size could not be economically justified.

Studies also showed that a reservoir at the Macclenny site at normal full pool elevation 80 feet would accrue large fish and wildlife benefits, small recreation benefits because of the large drawdown of the pool, and insufficient hydroelectric power benefits to justify the hydroelectric power facilities. A dam and reservoir of this size, therefore, would not be feasible economically. A reservoir at normal full pool elevation 100 would be high enough to have a suitable shoreline for recreation use. A drawdown of only 3 feet would, except during severe drought, permit the flow of ample water for low streamflow regulation and a suitable pool for recreation. However, no hydroelectric power facilities could be justified by this proposal, and the fish and wildlife and recreation benefits which would accrue from the project could be obtained at less costs by alternative means.

Studies were also made of the possibilities of utilizing the flows of the Suwannee and St. Marys Rivers primarily for the development of hydroelectric power at the Macclenny site. The power pool thus created would fluctuate from elevation 105 to 93 or 12 feet. The power benefits obtained from the project would justify only the cost for the power facilities. Because of the large drawdown of the pool, the recreation benefits would be small. Furthermore, the size of the pool was too large to be fully utilized for fish and wildlife and recreation. The costs for the Suwannee-St. Marys Rivers project were greater than the benefits. It is pointed out, however, that because of the complexity and magnitude of the studies required, it should be given further consideration in the future. At that time consideration should also be given to the possibility of storing water for use by Jacksonville, Florida. There is no foreseeable need, at this time, for a surface water supply for Jacksonville; but, there is also no assurance that the ground water supplies for Jacksonville are not exhaustible. Further details on this proposal are given in the report on the Suwannee basin.

The St. George site was considered primarily for an afterbay in connection with the development of the Macclenny site for the production of hydroelectric power. Its use as an afterbay for pumped storage for the Macclenny site could not be justified in the present study.

Little Hurricane Creek — The project included a dam and reservoir for low-flow augmentation for pollution abatement and fish and wildlife. The reservoir area and capacity at normal full pool would be 5,000 acres and 60,000 acre-feet, respectively. The cost of the dam and reservoir is estimated at \$5 million. The same benefits for recreation and fish and wildlife could be obtained at the Upper Hurricane site at a dam and reservoir cost of about \$4,300,000. In addition, the Upper Hurricane site would furnish greater pollution abatement benefits because it would dilute other wastes from Alma, Georgia.

A reconnaissance of the Alabaha River site for recreation, fish and wildlife, and other purposes rejected the site as not as suitable for these purposes. No estimate of cost was made of the project, but the topography is unfavorable for reservoir development at a reasonable cost.

Spanish Creek, Lower Site; Spanish Creek,

Bethel Church site; Mays Bluff Branch; Buffalo Creek; and Little Buffalo Creek sites were eliminated because the small streams on which they are located are suitable for fish and wildlife without impoundments, they are too near the coast to be extensively used for recreation, and there are other sites in more suitable locations for development. Those sites near the headwaters of the Satilla River offered more opportunities for development as there is a need for downstream flow regulation for fish and wildlife use and pollution abatement.

Little Satilla Creek project was proposed for recreation and fish and wildlife use. Low streamflows would be augmented by it for fish and wildlife benefits but no pollution abatement would be accrued. At normal full pool elevation, the reservoir area would be 2,500 acres and the capacity 32,000 acre-feet. The dam and reservoir estimated cost is \$3,100,000. This project was rejected because of the proposed Big Satilla Creek project which offers better shores for recreation development. The project would be particularly desirable for fish and wildlife use.

Douglas and Seventeen Mile Creek sites in the vicinity of Douglas, Georgia, were proposed for fish and wildlife, recreation, water supply, and pollution abatement. They were eliminated because first, water for Douglas could be obtained from wells at less cost than from surface sources; second, pollution from Douglas and Broxton, even after treatment, would contaminate a portion of the Seventeen Mile Creek site; and third, a suitable and satisfactory reservoir could be developed for less cost at the Axson site.

Development costs for Thomas Creek and Upper Thomas Creek on Thomas Creek were too great as the land is flat and marshy. Furthermore, the proposed Nassau River Embayment project would fulfill the needs for impoundments in the Nassau River watershed.

Water supply — Preliminary studies were made of the possibility of developing surface water supplies for Douglas, Georgia. These studies indicated that water supply from reservoirs would cost about \$100 per acre-foot. The comparative average cost for obtaining water from wells in the Satilla-St. Marys basins is about \$53 per acre-foot. These prices do not include the water treatment costs which would be much higher for surface water.

Navigation — A preliminary study was made of the possibility of constructing a barge canal connecting the Atlantic Ocean to the Gulf of Mexico by way of the St. Marys and Suwannee Rivers. The roughly estimated cost of this project is \$300 million. It was concluded that the first cost and operation, maintenance, and replacements costs for a barge canal along the St. Marys-Suwannee Rivers would be much greater than for the proposed Florida canal and that the navigation benefits would be less.

To provide a 9-foot channel in the Satilla River below Waycross would require dredging work and construction of three or four locks and dams. A rough estimate of the cost of canalizing the stream would exceed \$60 million. Due to the low streamflows at Waycross during dry periods, it might also be necessary to construct a storage reservoir to regulate the streamflow and to provide sufficient water for lockages. The benefits which would accrue from such work would not justify the costs.

Suwannee Basin

In order to determine whether functional needs for water control in the Suwannee basin could be provided in multiple-purpose systems, each major stream was analyzed by starting at its headwaters and considering the multiple-function potentials of each suggested control system. The objective was to identify the feature or combination of features that would satisfy the greatest portion of the total need at the least possible cost. The whole water control system is designed to cut down floodflows and augment low flows, and at the same time, to meet other needs for stored or controlled water. The Suwannee River gage at Ellaville was used as a control point for the system studies, since it was found that if the flow at Ellaville could be controlled to acceptable limits, the flows both upstream and downstream would generally be in usable ranges. The system is divided into four more-or-less distinct but related subsystems—the Withlacoochee, Alapaha, Santa Fe, and Suwannee main stem.

The studies leading to the water control plan for the Suwannee basin are briefly summarized in the following paragraphs and excluded sites are identified and the reasons for their exclusion are explained.

Withlacoochee River basin — On Okapilco

Creek, the westernmost tributary of the basin, it was found that storage was needed above the city of Moultrie. The best site for a reservoir that might provide the needed control was found to be the Moultrie site on Okapilco Creek about 3 miles north of the city. The drainage area above the site totals 29 square miles, and the mean annual runoff amounts to 16,000 acre-feet. The site will not produce all of the water needed for future sewage dilution in drought years. However, it was found that there is a surplus of water in Warrior Creek, a tributary of Little River east of the Okapilco drainage area. Construction of a 40,000 acre-foot reservoir at the Warrior Creek site and a future diversion into the Moultrie reservoir would provide the needed flow; and at the same time, it would provide some additional values for low-flow augmentation on Warrior Creek and Little River. The diversion will not be needed for many years and is not included in current plans, but it is physically possible and can be added whenever the need justifies it or some other development pre-empts the site. The Warrior Creek dam would be about 50 feet high and 4,500 feet long.

The Withlacoochee River is the major producer of floodflows in the Suwannee basin and has the greatest potential for effective control. There are several towns in the upper portion of the basin that need additional streamflows for pollution abatement. Several small sites above Nashville were investigated but none would meet the needs at a reasonable cost.

Original plans for the Withlacoochee River envisioned a dam on the stream at the Valdosta site about 3 miles west of Valdosta and about 5 miles below the mouth of the Little River. A reservoir at this location would control the major flood-producing area of the Suwannee basin and would provide the ideal water control arrangement. It was necessary to abandon the site, however, for two reasons. First, the river enters cavernous limestone formations just below Valdosta and crosses an artesian aquifer recharge area. It is very doubtful that a reservoir in this location would hold water. Second, in order to get the needed storage capacity, the reservoir would inundate areas within the city of Valdosta that are already developed. During high flood periods, it would create, rather than alleviate, flood problems in the Valdosta area.

As alternatives to the single reservoir, the possibilities of a combination of dams on the Withlacoochee and Little Rivers were studied. A series of 10 potential sites, all within 10 miles of the confluence of the two streams, was analyzed. It was found that the optimum sites were the Shiloh site on Little River about 2 miles above its mouth, and the Withlacoochee site on Withlacoochee River about 4 miles above the mouth of Little River. These two reservoirs would provide substantially the same degree of control as the Valdosta reservoir and would avoid its major problems. Storage at the Withlacoochee site is expensive, however, partly because the reservoir would inundate some valuable agricultural land. The benefits do not justify the cost of the reservoir under current conditions. A substantial part of the benefits of the Withlacoochee reservoir can be obtained by construction of a smaller reservoir at the Nashville site about 20 miles upstream. The Nashville site produces less overall benefits, but it has greater net benefits and so was included in the development plan.

A site on Little River near Adel offers some advantages over the Shiloh site, but it was abandoned primarily because it would inundate the recently constructed Cook-Colquitt Reservoir.

After the Shiloh and Nashville sites had been selected, costs and benefits for various sizes of structures were estimated, and the size that produced the maximum net benefits was adopted. In order to provide the needed control, Shiloh reservoir will fluctuate rather widely between maximum and minimum stage. There is a need for water-based recreation in the northern part of the Suwannee basin, and it is expected that Shiloh reservoir will get substantial recreational use. However, it is not well adapted to all types of water-based activities. Therefore, an auxiliary reservoir for recreational use was sought. The Valdosta site was considered for use based on a low head recreational lake but was abandoned for the same reasons that applied to the larger structure. A storage site on Franks Creek, a tributary of Little River that enters the stream below Shiloh damsite, proved to be attractive, particularly since it lies adjacent and parallel to the new U. S. Interstate Highway No. 75, and the damsite is adjacent to a major Valdosta interchange.

A storage site on Little River adjacent to Tifton would provide the regulation needed between Tifton and the Shiloh reservoirs and would insure the quantity and quality of flows needed to maintain a satisfactory water supply in the Cook-Colquitt recreational reservoir. Sewage and industrial wastes from the city of Tifton are discharged in part to Little River and in part to New River in the Alapaha drainage area. The possibility of diverting water from the Tifton reservoir to New River was considered, but it was found to be too expensive to justify the cost. Wastes discharged into New River could be transported to Little River, if such is found to be desirable, after Tifton reservoir is installed. The flow requirements for fish and wildlife and other purposes that are provided for in Tifton reservoir are adequate to provide dilution water for the entire effluent from the Tifton area to the year 2000.

Alapaha River basin — The Alapaha River, like other northern tributaries of the Suwannee, produces large floodflows, but it goes dry during drought periods. Even with these unsatisfactory flow conditions, the stream is the focal point for most of the development in its basin. With control, the stream would provide excellent opportunity for further development and would enhance an already attractive fishery. Control of the Alapaha River is not as urgent as control for other streams, but it certainly must be considered as a long-range need if the area it drains is to keep pace with progress in other parts of the basin.

Several storage sites in the tip of the basin near Rochelle were considered, but they were abandoned because they did not control enough drainage area to have any significant effect on downstream flows. Several sites were also considered in the vicinity of Willacoochee. The Alapaha site appeared to provide the best storage. It was originally planned to develop the site to its physical limits. This would permit impounding as much floodwater as possible for later release and downstream use or for diversion to the White Springs or Macclenny power system.

In an effort to identify potential peaking capacity, a power potential on the St. Marys River near Macclenny, Florida, has been investigated. To increase the waterflow, the plan envisaged diverting water by way of Suwanoochee Creek

from the Alapaha River south of Lakeland, Georgia, to a reservoir created by a dam on the Suwannee River near White Springs, Florida. From the White Springs reservoir a canal would connect to the reservoir created by a dam on the St. Marys River at the Macclenny site. The power potential would utilize a gross head of 60 feet, develop 60,000 kilowatts of peaking capacity, and have an annual generation of 75 million kilowatt-hours of energy. The estimated cost of the powerplant and auxiliary equipment is \$21 million. The annual costs of the power facilities are estimated to be \$1,708,000, under Federal financing. The benefits are estimated to be \$1,858,000. Reversible-turbine installations were considered but pumped storage was found to be infeasible. The conventional development would pay for the power facilities, but would cover only a small part of storage cost. The incremental storage costs assignable to power are greatly in excess of the residual benefits so power was eliminated from further consideration.

The diversion plan would have the very significant advantage of moving floodwater from the Suwannee basin to the St. Marys basin where it could be released within channel capacities of the stream. Studies of this diversion system showed that the total benefit would exceed the costs. However, when power was eliminated from the plan on an incremental basis, the entire cost of the transbasin diversion works had to be borne by flood control. The benefits for flood control would not support the full cost of the diversion and other flood control features so the diversion plan was abandoned. White Springs reservoir is discussed further in a subsequent part of this Section.

Elimination of the transbasin diversion eliminated the need for power storage in Alapaha reservoir. Therefore, it was resized to supply the demands of the Alapaha River for low-flow maintenance and for a limited amount of flood control.

The Alapaha diversion reservoir would be well adapted to recreation use, because of the stable water surface it would provide and anticipated recreation use would provide benefits in excess of the related costs. The same benefits can be provided at other reservoirs without increasing their cost significantly so the diversion reservoir was deleted from the plan.

Santa Fe River basin — The Santa Fe River basin is almost entirely underlain with the cavernous limestone formations that make surface water control difficult, if not impossible. These formations have the advantage of producing many springs which help maintain streamflows during drought periods, and also accept water readily during flood periods and reduce flood peaks in the surface streams. However, there are many localities, such as Alachua, in the Santa Fe basin where water control is needed, but, in every case considered, no feasible storage site was found.

A growing interest in the area resources development is evidenced by a 1960 report on the practicability of constructing a small boat inland waterway between the St. Johns River and the Suwannee River via the Santa Fe River. Economic feasibility studies were not included, but sufficient cost comparisons were evidently made to pick the least costly of several alternative routes.

The study which was prepared for county governments in the Santa Fe basin concluded that the most likely route for a waterway with a 40-foot width, 4-foot depth, and 10-foot clearance, between the St. Johns River and the Suwannee River, would cross the Oklawaha River where it coincides with the Cross-Florida Barge Canal alignment near Orange Lake and follow existing creeks where possible. It would then proceed westward through Lockloosa Lake, angle northward through Lake Santa Fe, and turn westward again to the Suwannee River via the Santa Fe River.

The portion of this 100-mile waterway between the Cross-Florida Barge Canal and Lake Santa Fe would require an estimated 12 locks with a combined lift of about 120 feet. The main problems likely to be encountered, other than the substantial lift, are related to low, narrow bridge crossings and the extensive excavation required to provide project dimensions. The 65-mile reach between Lake Santa Fe and the Suwannee River would probably require one more lock than the eastern reach, because there would be additional problems of water level maintenance at rapids and of disappearing river sections where the Santa Fe River goes underground.

The proposal has not been included in the

comprehensive plan because the apparent benefits would not support the costs. Local needs and desires may outweigh conventional economic analyses and such a proposal may be worthwhile as a local undertaking. Support for the development is derived largely from boaters and businessmen in the counties with direct access to the waterway. About 5,000 boats were registered in these counties during the summer of 1960, and boat sales have been increasing steadily. Whether the waterway is constructed or not remains to be seen. However, increasing efforts of various individuals to find recreational waterways, does testify to the growing demand for this type of resource development.

Suwannee mainstream — The Corps of Engineers has made several studies of the possibilities of storage on the Suwannee River to provide flood control, navigation, and other benefits. Sites at Bell, Ellaville, and White Springs have received particular attention, but the studies have found that the developments were not feasible for the uses considered.

The Corps studies were reviewed, and there appears to be no reason to believe that conditions have changed enough to alter the conclusions reached when the studies were made several years ago. One of the main problems was the uncertainty about geologic conditions in the reservoir areas. Besides, the plans considered in this Report are based on the assumption that the lower Suwannee River, in its natural state, provides a far more valuable attraction as an esthetic and scenic, and recreational area than it would be as a storage site.

The upper Suwannee is controlled, to a minor degree, by the sill, or low dam, at the outlet of Okefenokee Swamp. The sill maintains a controlled water surface elevation in the swamp and has a minor beneficial effect on floodflows. It would tend to increase transpiration and evaporation losses during drought periods, and thus aggravate low-flow problems. The sill is not operated to provide downstream benefits, so the flood and low-flow needs of the Suwannee River above the mouth of the Alapaha River can only be met by additional storage below the swamp. A damsite at Fargo, just below the State line, was considered, both as part of the St. Marys diversion scheme and as an independent reser-

voir. It was abandoned because the White Springs site just above Suwannee Shoals would provide more storage, at no increase in cost, with less inundation of stream channel. The White Springs reservoir was an integral part of the Alapaha-Suwannee-St. Marys diversion. When the diversion plan was abandoned, the White Springs reservoir was considered for its value in maintaining streamflows in the Suwannee above Ellaville, for reducing floodflows, and for other purposes. The development was found to be justified economically on the basis of the benefits it would produce, but it was also found that a large part of the needs could be supplied by storage in the Withlacoochee River system. There is considerable interest, both locally and from the national viewpoint, in keeping the Suwannee River unobstructed from Okefenokee Swamp to the mouth. Therefore, White Springs reservoir was not included in the proposed development. Thus the river between White Springs and the mouth of Alapaha River will not have the benefit of upstream control. If the low dam being constructed near Suwannee Springs by the Suwannee River Authority proves to be satisfactory, it will maintain adequate water depths for boating through part of the problem area. An additional low dam downstream could be installed to control water depths in the other significant shoal area that lies above the point where adequate low flows can be provided from the Alapaha and Withlacoochee systems. These low dams, like the larger ones, will change the regimen of the stream by creating slack-water pools that are objectionable to preservation interests. The pool areas, however, will be entirely within the lower limits of the stream valley and their effects will hardly be discernible from the streambank. If the dams are successful, some convenient means for getting boats over, around, or through them would be desirable.

Study of the effects of floods on Branford indicated that about half of the potential damages would be prevented by features of the proposed plan and that remaining benefits would not justify the levee systems that were considered.

Ochlockonee Basin

Flood control — Flood control studies of the Ochlockonee River demonstrate a need for water storage facilities, although the needed reservoirs

cannot be justified for flood control alone. Other improvements including levees, channels, and diversion of floodwater were considered. The only improvement that warranted further consideration for flood control alone is a levee project for the town of St. Marks, Florida, which is included in the plan. A levee for the town of Newport, Florida, was studied but construction of this project does not appear to be economically justified. A cooperative endeavor by the city of Perry, Florida, and the Buckeye Cellulose Corporation has alleviated at least part of the flood problems on the Fenholloway River. Channel capacities have been increased and bridge restrictions on Spring and Pimple Creeks have been removed. The Buckeye Cellulose Corporation has diverted part of the headwaters of the Fenholloway River into the Econfina River watershed by constructing a major drainage system to reclaim extensive areas for wood production in San Pedro Bay north of Perry. This present system of combined flood protection and drainage should be analyzed hydrologically before considering any additional plans for flood protection on the Fenholloway River.

Navigation — After the authorized Cross-Florida Barge Canal is constructed, navigation traffic will undoubtedly increase in this area and by far the longest unprotected section of the Intra-coastal Waterway system will be from Carrabelle, Florida, to the mouth of the Withlacoochee River. To accommodate navigation traffic in the Ochlockonee basin the Gulf Coast Improvement project; the Intracoastal Waterway Extension from Carrabelle, Florida, to Apalachee Bay; the St. Marks Channel Improvement; the Panacea Channel Improvement; and the Steinhatchee River Improvement for recreation and fishing craft were considered.

Other navigation projects considered that studies indicated were not economically justified are covered in the following paragraphs.

Gulf Intracoastal Waterway, authorized route via Crooked River — The present channel of the Gulf Intracoastal Waterway terminates in Carrabelle Harbor. The plan of improvement considered would provide for a 12- by 125-foot channel along the route authorized by the River and Harbor Act of 26 August 1937 and amended by the Act of 23 July 1942, from Carrabelle Harbor via Carrabelle, Crooked, and Ochlockonee

Rivers and Ochlockonee Bay to the 12-foot depth in Apalachee Bay. The project would involve numerous cutoffs and widening of bends to facilitate navigation by modern barge tows. Overall length of the project would be about 31 miles. Excavation would amount to about 4,700,000 cubic yards of earth and 23,000 cubic yards of rock. Spoil from excavation in the river section would be placed on land whereas in Ochlockonee Bay spoil would be placed overboard. In order to provide proper navigational clearances under existing bridges, alterations would be required to four highway bridges, namely: U. S. Highway No. 319 bridge across Carrabelle River, State Road No. 67 bridge across Crooked River, U. S. Highway No. 319 bridge across Ochlockonee River, and U. S. Highway No. 98 bridge across Ochlockonee Bay. Alterations to several powerlines and telephone lines would also be required.

Small craft channel along route of the Gulf Intracoastal Waterway — Consideration was given to provision of 6- by 60-foot channels for small recreational and commercial fishing craft along the same route as described for the Gulf Intracoastal Waterway in the above paragraph. This project would not appreciably benefit commercial fishing interests; however, some use might be made of the channel by a few small craft proceeding between Carrabelle and St. Marks.

Small craft channels in Ochlockonee Bay — Small craft based along the shores of Ochlockonee Bay are able to reach the main channel leading to Apalachee Bay by circuitous routes and are often delayed by shallow depths in the shoal areas. Two channels branching from deep water in the center of the bay above the bridge to each of the natural channels along the north and south shores would provide access by vessels based there to Apalachee Bay and the Gulf. Channels considered would be 6 feet deep and 60 feet wide for an overall distance of about 8,000 feet.

Extension of St. Marks River Channel from St. Marks to Newport — The existing 12-foot project channel for St. Marks River terminates at a point 3,400 feet upstream from the turning basin opposite the town of St. Marks. The controlling depth between St. Marks and Newport is 7.5 feet. Provision of a 12- by 100-foot channel

from the head of the existing project to Newport would involve excavation of 475,000 cubic yards of sand, silt, and shell and 152,000 cubic yards of rock. Length of the extension would be slightly less than 3 miles. There are no industries or establishments along St. Marks River above St. Marks which would generate any waterborne commerce. The few small craft based along that reach can navigate the river in its present condition without difficulty. In view of the above, it appears to be reasonably certain that there will be no need in the foreseeable future for improvement of the river more than 3,400 feet above St. Marks.

Barge channel — Steinhatchee River — Consideration was given to a barge canal 12 feet deep and 150 feet wide from the mouth of the Steinhatchee River to about river mile 10.

Barge channel — Fenholloway River — As an alternate to the Steinhatchee barge channel, a channel 12 feet deep and 150 feet wide from the Gulf of Mexico to Perry, Florida, was studied. This channel would generally follow the Fenholloway River channel.

Water control projects — Pollution studies identified many areas in the basin where storage is or will be needed to provide water for dilution of municipal or industrial wastes, even after reasonable treatment is provided. Sport fish and wildlife studies show a need for low-flow augmentation to protect fish and enhance fishing and a need for additional large water bodies to meet the demand for that type of fishing. Recreation studies point up the lack of sufficient access points to the Gulf coast, particularly in the southern part of the basin and the dearth of water-based recreation opportunity in the upper part of the basin. These studies also indicate that large numbers of recreationists can utilize reservoirs.

Many opportunities for comprehensive planning in the Ochlockonee basin lie in devising methods to obtain the best use and establish needed control of the surface waters. The location and type of facilities suggested to obtain the needed control for each of the functions are not always identical. Original selections of dam and reservoir projects were based primarily on physical factors without much regard for economic values. When a rough plan had thus been identified, it was refined by determining, first, that

the plan was in itself economically feasible, and second, that there were no alternatives for meeting the same objectives that were economically more attractive. This involved an incremental analysis of various sizes of facilities at the selected sites to establish the size of development that would produce the greatest net benefit. It also involved comparison of the selected site or program with alternative sites.

On the basis of physical limitations, functional requirements in the area and preliminary cost estimates, as determined by map studies starting at the headwaters of each stream, tentative sites for 24 potential dam and reservoir projects which appeared to meet the greatest portion of the total needs at the least possible cost were selected for investigation. Fourteen of the sites were eliminated by office studies and field observations because (1) they were not suitable sites from the construction standpoint, (2) it was obvious the benefits would not justify the costs, (3) a better site in the same general area would satisfy similar needs, or (4) relocation costs would be excessive. Six additional sites were studied in more detail and were also excluded from the plan. The excluded sites are summarized in Section VI, Part Four, of Appendix 6.

Other projects — Raising and stabilizing water levels at either Lake Iamonia or Lake Jackson, or both, were considered as alternative possibilities for satisfying some water-oriented recreation activities and for increasing the fishing use on these lakes which are badly choked with waterplants. The water level would be stabilized 1 or 2 feet above the present normal water level by diverting floodwaters from the Ochlockonee River. A preliminary cost estimate of the features needed to stabilize the water level at both lakes, excluding land costs, was \$525,000. Works considered in this estimate included a dam on the Ochlockonee River to divert floodwaters into a system of canals leading from the Ochlockonee River to Lake Iamonia, then to Lake Jackson, and from Lake Jackson back to the Ochlockonee River. Appropriate structures in the connecting system of canals would regulate the lake levels. An additional control structure where U. S. Highway No. 19 crosses Lake Iamonia would permit use of the area east of the highway as a waterfowl conservation area.

Stabilization of the water level of Lakes Iamonia and Jackson at a slightly higher elevation than the present normal level would greatly increase the value of the lakes as recreation areas for boating and water skiing; it would permit increased fishing use; it would increase property values along the lake frontage; it would also be possible to temporarily store considerable volumes of the Ochlockonee River floodwaters in these lakes; and by providing a few more facilities and access points, they could be developed into attractive swimming areas. Lake Bradford near Tallahassee is similar to Lakes Iamonia and Jackson and is an example of a perched water-table lake that has been developed by private interests into an attractive lake used extensively for swimming. However, even though stabilization of Lakes Jackson and Iamonia appears to have a great potential for increased recreation and fishing use, it is not included in the basin plan because the underlying cavernous limestone makes the possibility of stabilizing the water levels at a slightly higher elevation very doubtful.

Even though the water levels at these lakes have been higher during rainy periods than the proposed stabilized levels, the increase in weight from the proposed higher lake levels might be sufficient to create or open additional limestone sinks during periods when the ground water table is at a low level and thereby cause more damage than benefits. This water level stabilization project should be reconsidered, if a future geology study is made of the area surrounding Lakes Iamonia and Jackson. Detailed geology data should be available before any increase in the normal water levels is recommended. Future studies may indicate the desirability of one or more structures to prevent the lakes from draining into existing sinkholes. If such structures are used, they could be designed both to prevent drainage of the lakes and to allow excess floodwaters to escape over the structure into the sinkholes and thereby aid in maintaining water in the artesian system.

Apalachicola-Chattahoochee-Flint Basins

Several studies were made for navigation on the Flint River. One considered extension of navigation on the Flint River above Albany to the vicinity of Drayton, Georgia, and thence across the divide to a tributary of the Ocmulgee

River. Excessive cost and the difficulty of providing water for lockage near the divide necessitated abandoning consideration of this project. Another navigation plan for the Flint River would provide a 9-foot channel from Albany to the vicinity of Jonesboro, Georgia. Insufficient streamflow and excessive costs necessitated dismissing this plan as a single-purpose project. Low initial tonnages and savings would prohibit extending navigation to intermediate points above Albany within the foreseeable future.

Consideration was given to providing a branch channel on Omussee Creek for barge navigation to Dothan, Alabama. This would have required construction of a dam and lock. Multiple benefits would have accrued for recreation, and fish and wildlife. The lack of appreciable natural resources or manufacturing activities near Dothan indicates this branch channel would not be justified, particularly since it would only eliminate a short overland haul to the State docks on the Chattahoochee River at Columbia, Alabama. A modified project for recreation, fish and wildlife, and other purposes was retained.

Consideration was also given to excavating a branch channel about 1 mile long on Omussee Creek which would terminate at a contemplated industrial park southwest of Columbia. Excavation of a suitable barge channel would involve excavation of 370,000 cubic yards, about 60 percent of which is rock. It does not appear that the branch channel is warranted at this time.

Excellent sites are available on the Chattahoochee and Flint Rivers and some of their tributaries for large dams and reservoirs. Most of these sites are in places still relatively unimproved and will present few major relocation problems. Multiple benefits would accrue from water supply, hydroelectric power, flood prevention, recreation, hunting and fishing, low-flow regulation, and pollution abatement, and in some cases, navigation and irrigation.

In the headwaters of the Chattahoochee River, development of the Tesnatee site is not economically feasible. Yahoola Creek and Dahlonega were eliminated in favor of the more economical alternative site of New Bridge. Preliminary investigations showed the Sautee site to be uneconomical. The Crow Bridge site was not considered beyond preliminary investigation because of its proximity to more favorable sites. Mossy

Creek and Bull Shoals were eliminated in favor of the more attractive Mud Creek site. Vinings was dropped from consideration because of the high value of existing developments in the reservoir area. Abrams Creek on the Flint River and Look and Tremble Shoals on the Chipola River are not economically feasible at this time. Field observations indicate that the Gum Creek site is not physically feasible. The Sweetwater Creek project is not economically feasible.

Studies in some detail were made on several sites on the Chattahoochee and Flint Rivers before they were finally eliminated as being uneconomical at this time. These included the New Bridge, Irwins Bridge, Mud Creek, Miona, and Mountain Creek sites.

New Bridge — The New Bridge damsite is located on the Chestatee River, in Lumpkin County, Georgia, 18.5 miles above its confluence with the Chattahoochee River, 6 miles south of Dahlonega, and 9 miles northeast of Dawsonville. The considered project consisted of a dam and reservoir, access roads, recreation areas, and a hydroelectric powerplant. The concrete gravity dam would have been 1,145 feet long, with an earth embankment 1,375 feet long on the right bank. The spillway was to be controlled by seven 39- by 26-foot tainter gates. The powerhouse was to be in the right bank. The reservoir extended upstream about 16 miles from the dam. The area which would be inundated is mostly wooded and relocations would be minor. Access points to the reservoir would have included facilities for fishermen and accommodated about 27,000 user-days of reservoir fishing. Information derived from the studies are summarized below:

Data	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	232
Dam	ft.	170
Maximum height	ft.	2,520
Length	ft.	
Reservoir		
Elevation, normal full pool	ft. m.s.l.	1,220
Elevation, minimum pool	ft. m.s.l.	1,165
Area, normal full pool	acre	5,900
Area, minimum pool	acre	2,650
Capacity, normal full pool	acre-ft.	320,000
Capacity, minimum pool	acre-ft.	70,000
Powerplant		
Installed capacity	kw.	50,000

Irwins Bridge — The Irwins Bridge site is located on the reach of the Chattahoochee River that forms the boundary between White and Habersham Counties, Georgia. It is 7.5 miles east of Cleveland and 6.5 miles west of Clarksville. The considered project consisted of a dam and reservoir, access roads, recreation areas, and a hydroelectric powerplant.

The dam would have consisted of a concrete gravity spillway section 355 feet long in the main channel, a concrete nonoverflow powerhouse section 597 feet long, and 420 feet of earth embankment. The spillway would have been controlled by 12 tainter gates and would have discharged 149,200 cubic feet per second with the design flood at headwater elevation 1,300 feet. The reservoir would have extended upstream about 7 miles from the dam. The area which would have been inundated is mostly wooded and relocations would be minor. Access points to the reservoir would have had facilities for fishermen to accommodate about 7,000 user-days of reservoir fishing annually.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	152
Dam		
Maximum height	ft.	115
Length	ft.	1,372
Reservoir		
Elevation, normal full pool	ft. m.s.l.	1,300
Elevation, minimum pool	ft. m.s.l.	1,275
Area, normal full pool	acre	1,550
Area, minimum pool	acre	820
Capacity, normal full pool	acre-ft.	39,600
Capacity, minimum pool	acre-ft.	15,800
Powerplant		
Installed capacity	kw.	20,000

Mud Creek — The Mud Creek site is located in Hall County, Georgia, on the Chattahoochee River 1 mile above the mouth of Mud Creek, 10 miles below the mouth of Soque River, 5.5 miles north of Lulu, and 9 miles southwest of Cornelia.

The considered project consisted of a dam and reservoir, access roads, access points, and a hydroelectric plant. The concrete gravity dam would have been 1,505 feet long and 147 feet high. A 540-foot long spillway in the main channel would have been controlled by tainter gates, which would provide a design flood capacity of

215,000 cubic feet per second. The powerhouse would be in the left bank. The reservoir would extend upstream about 12 miles from the dam. The area which would be inundated is mostly wooded and relocations would be minor. Access points to the reservoir would have included facilities for fishermen to accommodate 15,200 user-days of reservoir fishing annually.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	377
Reservoir		
Elevation, normal full pool	ft. m.s.l.	1,197
Elevation, minimum pool	ft. m.s.l.	1,167
Area, normal full pool	acre	3,350
Area, minimum pool	acre	1,750
Capacity, normal full pool	acre-ft.	140,000
Capacity, minimum pool	acre-ft.	52,500
Powerplant		
Installed capacity	kw.	36,600

Miona — The Miona damsite is on the Flint River in Macon County, Georgia, 193.5 miles above the mouth, 39.9 miles below Lower Auchumpee Creek site, 7 miles above Oglethorpe and Montezuma, and 2 miles below the mouth of Toteover Creek. Miona State Park is on the right bank at the site. The Atlanta, Birmingham and Coast Railroad and State Highway No. 128 would provide access to the site from the right bank, and the Central of Georgia Railroad and State Highway No. 49 would provide access from the left bank.

This considered project would serve the multiple-purposes of power, recreation, and fish and wildlife. Studies of pool elevations, including combinations with the Nakomis site, indicated that a pool elevation of 320 feet would affect development of this section of the river. This elevation would require slight raising of the Central of Georgia Railroad crossing at the Nakomis site, 21 miles upstream. Facilities would be provided for fishing, picnicking, swimming, boating, camping, and sightseeing to satisfy the requirements for 325,000 user-days annually.

The dam would have been an earthfilled structure with a hollow-concrete powerhouse intake structure and spillway section in the main river channel. The overall length would have been 6,395 feet with a height of 70 feet above the riverbed. The spillway was to be controlled by

twenty 35- by 21-foot tainter gates and would have passed 336,000 cubic feet of water per second, the design flood, at a head of 25 feet or elevation 325 feet. The powerhouse would have been in the main channel at the left bank end of the spillway. The reservoir would have covered 24,750 acres and impounded 22,000 acre-feet of usable storage at a drawdown of 1 foot.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	2,366
Dam		
Maximum height	ft.	70
Length	ft.	6,395
Reservoir		
Elevation, normal full pool	ft. m.s.l.	320
Elevation, minimum pool	ft. m.s.l.	319
Area, normal full pool	acre	24,750
Area, minimum pool	acre	24,000
Capacity, normal full pool	acre-ft.	412,000
Capacity, minimum pool	acre-ft.	390,000
Powerplant		
Installed capacity	kw.	39,000

Mountain Creek — The Mountain Creek site is located 31.7 miles downstream from Miona site on that part of the Flint River forming the boundary between Sumter and Dooly Counties, Georgia. Mountain Creek flows into the Flint River through its right bank 2.2 miles above the site. Americus is 14 miles west of the site and Vienna is 12 miles east. The nearest railheads are the Central of Georgia Railroad, 9 miles from the right bank and the Atlanta, Birmingham and Coast Railroad, 7 miles from the left bank. The nearest through-highway is State Highway No. 27, which crosses the Flint River 4 miles below the damsite to link Americus and Vienna.

Power, recreation, fish and wildlife were the primary purposes of this considered project. This is the only site suitable for a dam to develop the full head between the existing Crisp County power development and the proposed Miona site. Facilities would have been provided for fishing, picnicking, swimming, boating, camping, and sightseeing to satisfy the requirements for 233,000 user-days annually.

The considered dam would have been 8,740 feet long and 60 feet high above the riverbed. It would have consisted of earthfill and rockfill abutments on the right and left banks and a

powerhouse intake section in the main channel adjoining a hollow-type spillway 1,720 feet long on the left bank. The spillway would have been controlled by 43 vertical lift gates, 23 by 40 feet, and would have discharged 378,000 cubic feet per second, the design flood, at a headwater elevation of 278 feet.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	3,192
Dam		
Maximum height	ft.	65
Length	ft.	8,740
Reservoir		
Elevation, normal full pool	ft. m.s.l.	272
Elevation, minimum pool	ft. m.s.l.	271
Area, normal full pool	acre	15,400
Area, minimum pool	acre	14,600
Capacity, normal full pool	acre-ft.	197,500
Capacity, minimum pool	acre-ft.	190,000
Powerplant		
Installed capacity	kw.	42,000

Pumped storage — Opportunities for pumped storage exist at many sites as integral developments where pump-generating units could be installed at the dam. Two outstanding possible developments were found where off-stream storage could be used for pump-generating plants. These are Anneewakee Creek and Dog River, both within 25 miles of Atlanta.

Estimates of the value of power from hydroelectric projects are based on the cost of producing power at modern steam-electric generating plants as the cheapest alternative source. A valuable service, which has not been evaluated in establishing the economic justification of hydroelectric projects, is the conservation of natural resources. When other power sources are used, the resources are consumed and lost. In contrast, the resource supply for hydroelectric power is continually replenished.

Anneewakee Creek site is on Anneewakee Creek, a tributary of the Chattahoochee River. It is located in Douglas County, Georgia, about 15 miles southwest of Atlanta, within the proposed Anneewakee recreation project area. This would have been pumped storage hydroelectric development. It involved a detached pump-generating plant which would pump from the Cedar Creek reservoir as an afterbay to an auxiliary impoundment at a higher elevation. The dam

would have been an earthfill structure with a maximum height of 197 feet and a length of 860 feet with an ungated side-channel spillway. The reservoir would extend upstream about 5 miles. The area which would be inundated is mostly wooded and relocations would be minor. Facilities would have been for fishing, picnicking, swimming, boating, camping, and sightseeing.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	29
Reservoir		
Elevation, normal full pool	ft. m.s.l.	915
Elevation, minimum pool	ft. m.s.l.	902
Area, normal full pool	acre	1,900
Area, minimum pool	acre	1,300
Capacity, normal full pool	acre-ft.	73,500
Capacity, minimum pool	acre-ft.	52,600
Powerplant		
Installed capacity	kw.	300,000

Dog River site is on Dog River, a tributary of the Chattahoochee River, in Douglas County, Georgia, about 20 miles southwest of Atlanta. It is within the proposed Anneewakee recreation project area, and is about a mile downstream from the Dog River site suggested for use in the adopted plan. This would have been a pumped-storage hydroelectric development. It involved a detached pump-generating plant which would have pumped from Cedar Creek reservoir as an afterbay to an auxiliary impoundment at a higher elevation. The dam would have been earthfill with a maximum height of 242 feet and a length of 9,340 feet. The spillway section would have had 3 gates 35 by 40 feet. The reservoir would have extended upstream about 7 miles; the area which would be inundated is mostly wooded; and relocations would be minor.

Facilities would have been provided for fishing, picnicking, swimming, boating, camping, and sightseeing.

Data

	Unit	Amount
Dam and reservoir		
Drainage area	sq. mile	74
Reservoir		
Elevation, normal full pool	ft. m.s.l.	992
Elevation, minimum pool	ft. m.s.l.	989
Area, normal full pool	acre	8,500
Area, minimum pool	acre	7,850
Capacity, normal full pool	acre-ft.	371,000
Capacity, minimum pool	acre-ft.	350,000
Powerplant		
Installed capacity	kw.	300,000

Choctawhatchee-Perdido Basins

Flood control studies of the mainstreams pointed out a need for mainstream storage or for flood plain zoning. Forecasting of streamflows was recognized as essential for proper management of water resources. Special studies disclosed a need for low-flow regulation to protect fish and enhance fishing and for additional water bodies to meet the demand for fishing. Other studies pointed out the lack of water-based recreation opportunity in the interior part of the basins and also showed how many of the recreation needs can be satisfied at reservoirs. Dependable streamflows are essential for full realization of the recreation potential of the streams. Navigation in the Choctawhatchee-Perdido basins, except for the Gulf Intracoastal Waterway and the deep-water ports of Pensacola, Panama City, and Port St. Joe is almost entirely limited to recreational boats. Part of the overall need for electric energy in the basins is for hydroelectric peaking power which can best be provided through the medium of water control. A dependable water supply for municipal and industrial use could be developed with impoundments in the upper portion of the basins to augment ground water supplies and in the coastal area to relieve the threat of salt-water intrusion into the fresh-water aquifer.

Choctawhatchee-Pea Rivers — Along the Choctawhatchee and Pea Rivers, floods cause damage in both rural and urban areas. In the rural areas, floods inundate farmland and affect public roads and railroads. Loss of livestock also is not uncommon. The principal losses in the small towns consist of damage to residential areas and small businesses such as sawmills, retail stores, and service establishments. Some damage occurs to camps in the flood plain that cater to hunting and fishing.

The channel of the Choctawhatchee River along most of its length contains sandbars, driftwood, and overhanging trees which obstruct flows. The flood plain is 90 percent wooded and is practically uninhabited from Caryville to the mouth. Agricultural damage from flooding is relatively small when considered on a stream mile basis and would not justify much improvement. Since channel clearing and snagging would not materially reduce flood stages, it was not

considered as a means of protection.

Above Geneva the flood plain contains good farmland that could be returned to production if protected by upstream storage. One possible site was located at mile 133 near Bellwood, Alabama. A reservoir here would regulate the runoff from 1,229 square miles or 20 percent of the basin. Urban development in the area above the damsite would limit the flood storage to the equivalent of 3.2 inches of runoff on that part of the basin. The structures considered for the site consisted of an earthfill dam with an average height of 55 feet and a length of about 10,000 feet. Storage at this reservoir would reduce stages at Geneva, Alabama, and at Caryville, Florida. Flood control alone would not justify this development. Storage limitations at this site eliminated consideration of economically sound recreation development or water storage for purposes other than flood control under present conditions. It was, therefore, necessary to consider other possibilities.

Consideration was given to the construction of a levee around Caryville, Florida. The town is located partly in the flood plain on the east bank of the Choctawhatchee River at mile 64. The ring levee considered had an average height of 16 feet at elevation 69 feet. This is 3 feet above the maximum flood of record. The 10,000-foot long levee and pumping station are estimated to cost three times more than the benefits.

Protection for recent developments occurring outside of the existing levee in the southwest section of Geneva, Alabama, adjacent to State Highway No. 27 was considered. A levee, 3,800 feet in length, would protect about 92 acres of residential property. The annual benefits were found to be less than the annual charges and the levee was eliminated from further consideration. Flood protection would be provided, however, by the proposed multiple-purpose Ariton dam and reservoir project.

A site for a headwater retention reservoir is located on the West Fork of the Choctawhatchee River about 8 miles northeast of Newton, Alabama, at mile 145. The dam considered would have a top elevation of 260 feet and consist of an earthfill structure averaging 60 feet in height and 4,500 feet in length. It would cost about \$10.2 million. The reservoir would regulate runoff from about 423 square miles of drainage area

and would have flood storage equivalent to 10 inches of runoff. Storage at this reservoir would eliminate flood damages at Newton, Alabama, and would lower flood stages at Geneva, Alabama. In addition, fishing and recreation would be provided at this site. The proposed dam and reservoir was analyzed for flood control use alone and for multiple-purpose use and determined to be not economically justified. Some flood protection to Geneva, Alabama, however, would be provided by the proposed Ariton project.

The Ozark project is a small dam and reservoir with a drainage area of less than 6 square miles, located on Hurricane Creek, 3 miles south of Ozark, Alabama. A dam with top elevation 263 feet would create a reservoir of about 125 surface acres for recreation. An investment cost of about \$400,000 for about 1,600 acre-feet of water makes the project not economically feasible when compared to alternatives.

Consideration was given to providing protection for an urban area on the Pea River outside the existing levee south of Elba and adjacent to the junction of Beaverdam Creek and the Pea River. There are about 240 acres of residential land in this area subject to flooding during high stages of the Pea River. A levee was considered which would tie into high ground adjacent to the local airport. It would be 10,300 feet long and average 10 feet in height. Annual benefits are estimated to be 25 percent of the annual costs and the levee project is considered not to be justified economically. Protection would be afforded by the proposed Ariton dam and reservoir project.

Improvement of the Choctawhatchee River for navigation to Geneva, Alabama, was considered. The investigation included a review of previous navigation reports, a review of hydrographic surveys, a field canvass made by personal interviews with shippers and receivers of raw materials and finished products to determine the volume of commerce moving into or out of the tributary area, and a review of commercial and statistical data on economic development in the tributary area compiled by the Choctawhatchee-Pea River Development Association and by Abbott-Merkert & Company, which was employed by the Florida Geological Survey.

Natural flows and topographic conditions elim-

inate the possibility of providing a dependable channel by open river methods. The only practicable method to provide a dependable channel would be by constructing a series of low lift locks and dams to overcome the 65-foot difference in elevation to Geneva. The low banks, wide flood plain and unfavorable foundation conditions, make the channel plan expensive. Annual benefits, based on prospective traffic and including recreation benefits for improvement to project depth of 9 feet, are estimated to be about 10 percent of the annual cost.

Yellow River — The flood plain is about 1.5 miles wide in the reaches below mile 25 and about one-half to 1 mile wide in the upper reaches. The soils are generally unsuitable for agriculture, except in the upper reaches, and less than 10 percent of the entire flood plain is cleared for farming. Because of the small amount of flood damage and the poor soils in the flood plain, no flood protection works were considered for this stream.

A site at Wilkerson Bluff, mile 30, was considered for water supply. Railroad and highway relocation problems limited storage to about 65,000 acre-feet. Although this would be adequate for the foreseeable demand for water supply, the unit cost was prohibitive in comparison with the Crestview site.

Blackwater River — Only about 5 percent of the flood plain of this coastal stream is cleared for farming. The soil is best suited for growing timber and no increase in farming in the flood plain would likely result from a reduction in the number of overflows. No flood control measures, therefore, were considered for Blackwater River. Local recreation and fishing needs can be met with small impoundments.

Escambia-Conecuh Rivers — The flood plain of the lower 60 miles of this river is in timber and floods do not cause appreciable damage. From mile 60 to the headwaters, flood damage to agriculture averages less than \$25 per mile. Studies indicate that the cost of channel rectification as a means of flood prevention is not warranted. A study of the topography and development along the flood plain indicates that the only possible location for a reservoir site would be in the vicinity of mile 110, about 20 miles below the Falls River hydroelectric powerplant. A dam at this location would be about 3 miles

long. The remainder of the flood plain is paralleled by either first class highways or the Central of Georgia Railroad. Annual costs of a project at this site would exceed the benefits.

Several multiple-purpose projects including flood control were considered for the protection of Brewton, Alabama. These were Brewton, East Lenox, and West Lenox.

East Lenox project with a drainage area of 62 square miles located on Burnt Corn Creek 1 mile east of Lenox, Alabama, would be a dam and reservoir for recreation and flood control purposes. A dam with top elevation 228 feet would form a reservoir including total storage capacity equivalent to 12.7 inches on the drainage area and 2,500 acres of surface area. The investment costs would be \$2.3 million. Flood protection for Brewton, Alabama, however, is provided in the plan with a less costly levee project. The recreation feature of the reservoir by itself would not be economically justified because the needs are met elsewhere in the plan.

West Lenox project with a drainage area of 22 square miles located on Bowsley Creek 1 mile west of Lenox, Alabama, would be a dam and reservoir for recreation and flood control purposes. Storage capacity equivalent to 35.6 inches on the drainage area and surface area of 1,600 acres would be created with top elevation of a dam constructed to elevation 248 feet. The investment cost would be \$1.8 million. A levee for the protection of Brewton, Alabama, provided in the plan is a cheaper alternative than the reservoir. Single-purpose recreation would not be economically justified, the needs being met in the plan at other locations.

Brewton project with a drainage area of 179 square miles located on Burnt Corn Creek, 2 miles north of Brewton, Alabama, would be a multiple-purpose dam and reservoir for flood control, recreation, and fish and wildlife. With top of dam elevation 135 feet total storage would be provided equivalent to 4.6 inches on the drainage area. Although more capacity would be desirable for flood control alone, the total investment cost would be about \$2.2 million. A levee at Brewton, included in the plan, is more economical than the protection afforded by the storage reservoir. The recreation and fish and wildlife features are not economically feasible.

A study was made of navigation, predicated on

improvement for modern barge traffic, from the river mouth to the vicinity of Andalusia, Alabama, at mile 134. Analysis was also made on the basis of terminating the waterway at Brewton, Alabama.

The studies and investigations made in connection with the report include review of all previous navigation and flood control reports, published commercial statistics, a canvass of shippers and receivers of freight in the tributary area to determine the present traffic flow pattern, a freight rate analysis to develop information on commerce that could reasonably be expected to move on the waterway at a savings in transportation charges, and preliminary cost estimates of improvement for barge navigation. All plans, estimates, and maps are based on available data.

No studies were made to determine the growth rate of the prospective waterway traffic and the savings. Because industrial activity in the tributary area is scarce except in the Pensacola port limits, it is considered unlikely that sufficient traffic and transportation benefits would accrue to warrant the high cost of the navigation project, and further studies of improvement of the Escambia-Conecuh Rivers for barge navigation are not warranted at this time.

Big Escambia Creek — The flood damages along Big Escambia Creek are concentrated in the Flomaton area and are about 80 percent urban. Agricultural flood damages are minor and would not warrant the cost of channel rectification. Increasing demand for recreation and fishing indicates that a reservoir would be desirable to supply these demands and to provide flood control for Flomaton. A site, at mile 10 on Big Escambia Creek, could meet these needs with an earthfill dam creating a reservoir to regulate the runoff from 325 square miles. The top of the dam would be elevation 140 feet with a maximum height of about 70 feet. It would cost about \$7.1 million. Flood control in the multiple-purpose reservoir is not justified, but a proposed levee is feasible and would provide protection to Flomaton. Although the reservoir and fish and wildlife purposes of the reservoir are justified, the needs can be satisfied more economically elsewhere.

Studies indicated a possible dam and reservoir site on the Sepulga River just below the confluence of Pigeon Creek for water storage. Inves-

tigations also indicated there would be extensive highway and railway relocations with excessive costs. Field inspection of the damsite indicated the presence of cavernous limestone in the river channel. Physical conditions eliminated this site from further consideration.

A reservoir could be constructed on Pigeon Creek just north of Alabama State Highway No. 55 to serve recreation and fish and wildlife purposes. The single-purpose recreation alternative would be one-half of the share of the costs of the existing Gantt reservoir and the single-purpose alternative for fish and wildlife would be a reservoir at the Pigeon Creek site with water surface elevation 223. The annual justifiable investment costs for these two purposes based on the alternatives is less than the annual costs of the total facilities and, therefore, the multiple-purpose project is not economically justified.

A dam and reservoir site was investigated on Patsaliga Creek just east of U. S. Highway No. 331, near Luverne, Alabama, to serve recreation and fish and wildlife purposes. Single-purpose alternatives were one-half of the share of the costs of the existing Gantt reservoir for recreation, and the cost of a reservoir at Luverne with water surface elevation 289 for fish and wildlife. The multiple-purpose Luverne project proved not economically justified.

There is an excellent site on Patsaliga Creek, about 6 miles upstream from the River Falls reservoir. Preliminary data indicate that a reservoir could be developed for recreation and fish and wildlife at a reasonable cost per unit of storage. Studies indicate, however, that the needs to the year 2000 could be met by development of the sites at Luverne and Newton, so the Patsaliga development was not considered further.

Greenville project is a dam and reservoir site with a drainage area of about 25 square miles on Persimmon Creek just north of State Highway No. 10, east of the city of Greenville, Alabama. A dam with top elevation 385 feet would create a reservoir for municipal and industrial water supply. With an investment cost of about \$2.2 million for about 17,000 acre-feet of water, the project is not economically feasible when compared to other ways of meeting the need.

Perdido River — Consideration was given to a site on the Styx River, a tributary of the Perdido River.

The Styx dam and reservoir project with a drainage area of 91 square miles located on the Styx River, 4 miles northeast of Rosinton, Alabama, was considered for recreation and fish and wildlife purposes. The alternative to this impoundment and the Crestview dam and reservoir proposal was a single-purpose reservoir at the Styx site with constant pool elevation 100 feet for recreation and elevation 75 feet for fish and wildlife. Although a project with normal full pool elevation 75 feet would be economically feasible, it was not included in the plan. Needs can be met adequately for less investment of facilities and more concentrated use at other locations, mostly at the proposed Crestview project.

Bay developments — Two multiple-purpose projects located on bays were considered for inclusion in the plan.

Burnt Mill Creek Embayment project on the north shore of West Bay would be located on Burnt Mill Creek about 10 miles northwest of Panama City, Florida, and about 200 feet upstream from State Highway No. 388. A dam

about 3,800 feet long with top elevation of 19 feet would create a reservoir for recreation and fish and wildlife. Although the project would provide annual benefits greater than annual costs, the project has not been included in the plan because the same recreation benefits can be obtained at an access area development on Choctawhatchee Bay for less costs.

Basin Bayou Embayment project would encompass existing Basin Bayou on the north shore of Choctawhatchee Bay. Basin Bayou is an enlargement of Basin Creek located about 6 miles west of Portland in Walton County, Florida. A dam would be incorporated in State Highway No. 20 bridge which crosses the Bayou about 0.1 mile upstream from Choctawhatchee Bay. The roadway, elevation about 4 feet, would create a fresh-water pool for recreation and fish and wildlife purposes. Annual benefits would exceed annual costs. However, recreation can be served equally as well at lower costs by access area developments on Choctawhatchee Bay. The project, therefore, has not been included in the plan.

SECTION VI – PREVIOUS STUDIES AND REPORTS

Many studies and reports have been prepared by both Federal and non-Federal groups on various aspects of resources and resource development in the Southeast River Basins area. A thorough review was made of these early reports to ascertain if usable data were contained in them. Also, a review of these earlier studies revealed many ideas that had been abandoned because they were not justified at the time they were evaluated or that were not needed or they were found to be infeasible from a less broadly based comprehensive viewpoint from that which the U. S. Study Commission is taking. The following Sections summarize pertinent studies and reports that were found.

Areawide Studies and Reports

The National Inventory of Soil and Water Conservation Needs completed December 1959 by the U. S. Department of Agriculture presents the 1958 status of soil and water resources by counties and States with projections of land and water uses and areas needing treatment to the year 1975. Included as part of this study is an Inventory of Watershed Needs showing the needs for project-type action for flood prevention, ag-

ricultural water management, and nonagricultural water management by major river basins. These data are available to local, State, and Federal agencies and organizations concerned with soil and water resources. Data from this inventory were used in the development of some of the agricultural information and soil and water uses in the Commission Report.

Some studies have been made of domestic and municipal water supply problems throughout the area, and a considerable amount of data are available concerning existing water supply systems. This information has been compiled by the States of Georgia, Alabama, and Florida and the U. S. Public Health Service for the Commission and has been used in the water supply studies for the several basins.

The State health departments have aided in the development of community pollution abatement programs by providing standards and data. The status of waste treatment facilities has been compiled by the States and the U. S. Public Health Service. Air pollution abatement, vector control, solid-waste disposal, and radioactivity have been studied as they relate to land and

water development. Public health aspects of the other categorical functions have been considered in the planning.

There have been no irrigation or drainage studies pertaining primarily to any of the basins in the area. Inventory-type data are available from the Conservation Needs Inventory, from agricultural census, and other publications. Several studies by agricultural agencies pertaining to irrigation and drainage in other areas have been used.

There have been no basinwide studies for industrial development in any of the basins in the area. The States and local organizations compiled considerable information that has been useful in the Commission studies. Some counties and cities have planning and development boards or commissions from which data were obtained.

Soil and forest conservation have both been the subject of many general studies and the results of these are applicable to the Southeast River Basins.

Preservation and enhancement of fish and wildlife resources have been given careful consideration by the States of Georgia, Alabama, and Florida and by the U. S. Fish and Wildlife Service. Specific studies have been made by the State of Georgia concerning the possible restoration of marine fisheries in and near the mouths of the rivers on the Atlantic coast. However, no specific long-range action programs have resulted from these studies.

No special studies of the recreation requirements of the area had been made prior to the Commission studies. However, information is available regarding the use and location of State recreation facilities and lands used for recreation. Investigations of the recreation potential of the Atlantic offshore islands by the National Park Service have provided useful information. Many historic sites have been identified and a number of books concerning the early settlement of the area are available.

Consideration has been given to salinity problems in the area and in a few cases these have been given special attention in the planning. Sediment control has been considered in connection with soil conservation studies in the January 1949 report of the U. S. Department of Agriculture and in other agency studies.

Previous investigations by the Corps of Engineers concerning hurricane protection and beach erosion control have been utilized to the extent that these are applicable to the Southeast River Basins.

Numerous reports and studies covering local areas or special problems are available. State agencies, or their contractors, have prepared reports on State segments of the area. These reports contain source material useful for background data.

Savannah Basin

Two basinwide studies have been made of the Savannah River by the Corps of Engineers. The first one, known as the "308" report, was prepared in response to provisions of House Document No. 308, 69th Congress, 1st Session, and printed in House Document 6, 74th Congress, 1st Session. This "308" report was on a comprehensive preliminary examination and survey of the entire basin covering navigation, flood control, power development, and irrigation. This report concluded that irrigation was unnecessary; that flood damages were not serious except at Augusta where protective measures were being carried out by local authorities; that certain additional power developments would be feasible when a market became available; and that no improvement of the stream for navigation, either alone or in combination with power development, flood control, or irrigation, should be undertaken by the United States at that time. The report is a valuable source of background data.

The second basinwide report by the Corps of Engineers was printed as House Document No. 657, 78th Congress, 2d Session, and was prepared in accordance with authority contained in the Flood Control Act approved June 22, 1936. The comprehensive plan for development of the Savannah basin described in this report was approved by the Flood Control Act of December 22, 1944. The Act also authorized construction of the Clark Hill project. In addition, the report recommended construction, when warranted, of 10 other hydroelectric plants including Hartwell, Goat Island, Middleton Shoals, Camp Creek, War Woman, Rogues Ford, Sand Bottom, Tallow Hill, Anthony Shoals, and Newry-Old

Pickens. It was concluded in the report that specific measures for protection against floods were not justified, but that the normal operation of the Clark Hill project for power would yield considerable flood control benefits; the increased minimum flow made available by power operation could be reregulated by the existing privately owned Stevens Creek Dam to give a minimum depth of 7.3 feet in the Savannah River up to Augusta; and the Clark Hill Reservoir would yield considerable incidental benefits to recreation, wildlife, maintenance of Savannah Harbor channels, and industrial developments at and below Augusta. Clark Hill Dam was constructed as a result of this report.

The Flood Control Act of May 17, 1950, Public Law 516, 81st Congress, 2d Session, authorized construction of Hartwell Dam and Reservoir as the second unit in the plan of development. Hartwell Dam has been constructed and the powerplant was completed in 1963.

The Corps of Engineers studied the possible development of Goat Island and Carters Island sites, between Clark Hill and Hartwell units, as alternative developments to Goat Island and Middleton Shoals sites which were approved in the Flood Control Act of December 22, 1944. The Chief of Engineers found that construction of dams with powerplants first at Carters Island and then at Goat Island would provide for the best comprehensive development of that reach of the Savannah River. However, in view of strenuous opposition to the two units by the State of South Carolina, the Chief of Engineers recommended that the projects not be authorized at that time. Consequently, the unfavorable report was issued January 13, 1961, as Senate Document No. 6, 87th Congress, 1st Session.

Trotters Shoals dam and powerplant site on Savannah River at the upstream portion of Clark Hill Reservoir has been studied by the Corps of Engineers as an alternative development to Goat and Carters Islands, and also as an alternative to Goat Island and the Middleton Shoals sites. A favorable report of the District Engineer and the Division Engineer on this development indicates that a project costing \$78,700,000 for an installed capacity of 310,000 kilowatts, at elevation 475 feet, would be preferable to the Goat Island—Carters Island units or the Goat Island—Middleton Shoals units.

Many reports relating to Savannah Harbor, dating back to Senate Document No. 1, 33d Congress, 1st Session, and printed in the Annual Report of the Chief of Engineers for 1853 have been prepared by the Corps of Engineers. House Document 110, 83d Congress, 1st Session, printed March 23, 1953, gives a summary of development since the first Federal funds totaling \$50,000 were appropriated by the Act of May 18, 1926. Further improvement of Savannah Harbor was recommended. Prior favorable reports were printed as House Documents No. 283, 76th Congress, 2d Session; No. 227, 79th Congress, 1st Session; and No. 678, 79th Congress, 2d Session.

Improvement of Savannah River between Augusta and Savannah has been carried out in accordance with the following: House Document 255, 51st Congress, 2d Session, which proposed a channel 5 feet deep, 75 feet wide and approved by the Act of September 19, 1890. House Document 962, 60th Congress, 1st Session, relating to bank improvements of some 25 miles below Augusta was approved by the Act of June 25, 1910. House Document 101, 70th Congress, 1st Session, relating to a channel 6 feet deep, 75 feet wide, and lock and dam was approved by Act of July 3, 1935. Senate Committee Print, 73d Congress, 2d Session, and the Act of August 30, 1935, authorized construction of the New Savannah Bluff Lock and Dam. Senate Document 6, 81st Congress, 1st Session, and the Act of May 17, 1950, authorized a channel 9 feet deep and 90 feet wide which is now under construction and scheduled for completion in June 1962.

The United States Department of Agriculture has studied the entire Savannah basin, and prepared a Survey Report, dated March 1951, which recommended a program for runoff and waterflow retardation and soil erosion prevention. Some of the work proposed in that report has been performed, and other work is underway in cooperation with owners, operators, and Soil Conservation Districts in the basin.

Ogeechee Basin

Few intensive studies have been made of the resources or resource problems of the Ogeechee basin; however, the area has not been completely neglected. Both the Corps of Engineers and the Department of Agriculture have sub-

mitted reports on flood control. A preliminary examination report of the Chief of Engineers, dated August 5, 1935, concluded that further study with a view to preparing plans for flood control works on the Ogeechee River was not advisable at that time. A preliminary examination and survey report by the Chief of Engineers, dated November 25, 1944, recommended that no improvements for flood control be made at that particular time on the Ogeechee River or its tributaries.

The Department of Agriculture preliminary examination of a program for runoff and water-flow retardation and erosion prevention on the watersheds of the Altamaha and Ogeechee Rivers was completed in January 1949, and a similar report on the streams between these two rivers was completed in September 1950. The reports indicated a need for further studies of the watersheds in the basin. These further studies were initiated but have not been completed. Because of the lapse of time since completion of the preliminary studies, the information contained therein has limited use in this Report.

The Corps of Engineers has made five navigation studies of the Ogeechee River in the last 50 years. In each study it was concluded that there was no immediate economic justification for improving the river for navigation. The results of the most recent of these studies are contained in a preliminary examination report on improving the river from its mouth to Midville, Georgia. The report was completed by the U. S. Army District Engineer on June 19, 1931. The recommendations were unfavorable since the cost of the improvement could not be justified by the prospective navigation benefits alone. Because 30 years have elapsed since the most recent of the five studies was completed, the information contained therein is of limited use in the current navigation studies.

Consideration was given to the development of hydroelectric power in the basin in studies completed by the Corps of Engineers in its reports of June 1931 and November 1944. No hydroelectric development was recommended. In addition, the Federal Power Commission has conducted investigations and studies in the basin.

In its reports of January 1949 and September 1950, the Department of Agriculture recognized

the need for further study of the soil conservation problems of the basin.

Altamaha Basin

The Altamaha basin has a long history of studies and reports by Federal or State agencies. Early reports by the U. S. Army Corps of Engineers were dated 1876, 1878, 1881, and 1890. The result of these surveys and reports was an authorized project for a 3-foot by 80-foot channel from the mouth of the river upstream to Millidgeville and Macon to be provided and maintained by snagging, clearing, and dredging. Funds were seldom adequate for maintenance, although the rivers were used by power-driven commercial craft from 1819 to 1934. Ten subsequent reports were prepared by the Corps of Engineers, including the "308" report of a general multiple-purpose study for the development of the river. The latter report was published in 1934 as House Document 68, 74th Congress, 1st Session. A later report of a similar nature, completed April 1949, was unpublished.

Recommendations other than snagging and clearing included modification of an existing levee around an industrial area at Macon and a multiple-purpose dam at Laurens Shoals on the Oconee River. A flood control and drainage project in the Townsend and Buffalo Swamp areas was found to be economically feasible, but was not recommended because of lack of local interest. The levee project at Macon was authorized in 1946 and construction was completed in 1950.

The Federal Power Commission made a comprehensive study of the basin for hydroelectric power development and other useful purposes and in a report prepared in 1945 presented a comprehensive plan designed to develop the power resource to the maximum degree possible, consistent with economic limitations; to provide substantial flood control, navigation, and flow regulation benefits; and to reclaim large areas of fertile river bottom lands. The plan included 24 new developments, redevelopment of 7 existing projects, and a diversion from 1 existing project. A total of 57 reservoir sites were studied in selecting the plan. This report was updated in a staff paper in 1954.

The Altamaha Development Association em-

ployed a consulting engineering company to prepare a report for the comprehensive development of the basin. This report submitted in 1947 contained a tentative proposal for developing 17 reservoirs and navigation facilities on the Altamaha and Ocmulgee Rivers for navigation, hydroelectric power, flood control, irrigation, and other beneficial purposes. This report showed benefits from the projects, but no costs were computed. A report on the traffic potential of the lower Altamaha River was prepared in 1957 for the development association by consulting engineers.

These previous reports indicated that over 30 potential hydroelectric powersites exist in the basin. The comprehensive plan of the Federal Power Commission was justified on the basis of 1944 prices, but later studies indicate that only one project, at Laurens Shoals, is justified for power alone. Other multiple-purpose projects where the power inclusion is desirable are the Goose Creek, Coopers Ferry, and the Abbeville projects.

The U. S. Department of Agriculture preliminary examination for a program of runoff and waterflow retardation and erosion prevention on the Altamaha and Ogeechee Rivers was completed in 1949. Both reports indicated a need for further studies of the watersheds in the basin. Other studies by the U. S. Department of Agriculture have included preliminary examinations or studies on 23 watersheds on which Public Law 566 applications have been received through 1960.

In preliminary examination reports of the Altamaha and Ogeechee watersheds and intervening areas dated January 1949 and September 1950, the Department of Agriculture recognized the need for further study of the soil conservation problems of the basin.

Satilla-St. Marys Basins

Many reports on the Satilla and St. Marys river basins have been prepared by the Corps of Engineers. The reports on the Nassau River or its tributaries consist of studies of Thomas, Mills, and Boggy Creeks for emergency snagging and clearing, primarily for flood relief and drainage. A brief summary of reports by the Corps of Engineers on the Satilla and St. Marys basins follows:

House Document No. 41, 62d Congress, 1st Session, transmitted to Congress April 29, 1911, was an examination and survey of Satilla River from the mouth to Burnt Fort, Georgia. It contained recommendations for a survey and limited improvements such as clearing the river of snags and other obstructions.

House Document No. 1113, 62d Congress, 3d Session, transmitted to Congress December 7, 1912, was a preliminary examination and survey of Satilla River above Burnt Fort, Georgia, and recommended that the river be made navigable up to that point. It recommended some limited improvements such as clearing the river of snags and other obstructions, and also recommended a survey to ascertain the cost of improvement.

House Document No. 834, 64th Congress, 1st Session, transmitted to Congress March 2, 1916, was a preliminary examination and survey of a channel between Baileys Cut of the Satilla River and the head of Dover Creek, Georgia. The recommendations were that no improvement be made at that time by the Federal Government since the project was not economically justified.

House Document No. 43, 71st Congress, 2d Session, transmitted to Congress November 25, 1929, contained a review of the report on a channel between Baileys Cut on Satilla River and Dover Creek, Georgia, and recommended that the cut considered in House Document No. 834 be constructed with increased size and made an alternate route of the Atlantic Intracoastal Waterway system.

House Document No. 52, 71st Congress, 2d Session, transmitted to Congress December 27, 1929, reported on the Satilla River and covered navigation, flood control, power development, and irrigation. The study considered the river from its mouth to Waycross and found no justification to recommend any of the improvements under study, excepting a navigable connection with Dover Creek.

House Document No. 697, 62d Congress, 2d Session, transmitted to Congress April 12, 1912, reported on examination and survey of the St. Marys River, Georgia and Florida. It recommended that the Federal Government improve this river by constructing a channel 17 feet deep and 200 feet wide to Crandall at mile 12.4 and to clear the channel of snags to a point above Kings Ferry at mile 37.2.

House Document No. 540, 64th Congress, 1st Session, transmitted to Congress January 11, 1916, reported on preliminary examination and survey of the St. Marys River, Georgia and Florida. This survey was made to determine the need for deepening the river channel to 22 feet from deep water in Cumberland Sound to the western corporate limits of the town of St. Marys. Because of the lack of economic justification, the District Engineer recommended that no improvements be undertaken; however, the Chief of Engineers recommended further improvement of the existing channel to provide a channel 20 feet deep and 200 feet wide from deep water in Cumberland Sound to the terminal of the St. Marys Kraft Corporation plant in North River with a cutoff in the North River and a turning basin near the mill terminal; and a channel 8 feet deep and 50 feet wide in St. Marys River between Crandall and Traders Hill at mile 57.8.

House Documents No. 227, 68th Congress, 1st Session, dated November 31, 1922, and No. 662, 80th Congress, 2d Session, dated July 8, 1947, recommended improvements for Fernandina Harbor, Florida.

In several reports — S. Doc. 132, dated May 25, 1930; H. Doc. 110, October 6, 1948; H. Doc. 40, October 14, 1899; H. Doc. 407, December 4, 1905; H. Doc. 326, October 12, 1909; H. Doc. 179, December 4, 1900; and H. Doc. 355, December 27, 1900 — the Chief Engineers recommended harbor and channel improvements at Brunswick, Georgia.

House Document No. 820, 76th Congress, 3d Session, transmitted to Congress June 6, 1940, recognized a serious erosion problem at St. Simons, Georgia. It recommended a survey and construction of a plan to prevent further erosion of 6,000 feet of shoreline at the St. Simons Lighthouse.

U. S. Army Engineer District, Savannah Corps of Engineers, prepared a report in cooperation with the city of Fernandina Beach, Florida, dated March 10, 1960. A plan to be undertaken by local interests, was recommended to restore and preserve the ocean shore from erosion.

Preliminary studies of the power possibilities of the south Georgia and north Florida region were initiated by the Federal Power Commission in 1944. The report dated December 1949 on the Suwannee-St. Marys-Satilla River basins con-

cluded that: (1) The independent multiple-purpose development of the Suwannee River, the St. Marys River, and the Satilla River was not economically feasible at that time; (2) the combined development of two or more of the rivers greatly enhances the feasibility and attractiveness of their development; and (3) the plan involving the combined development of the Suwannee, St. Marys, and Satilla Rivers is the best means of developing the water resources of the region and that the plan presented warranted further detailed studies.

As of January 1960, local interests had applied for assistance under the Watershed Protection and Flood Prevention Act, Public Law 566, 83d Congress, as amended by Public Law 85-824, 85th Congress, for two watersheds in Florida and 10 watersheds in Georgia in the Satilla-St. Marys basins. Since then, work plans for Mills Creek Watershed in Nassau, Duval, and Baker Counties, Florida; Bishop Creek Watershed in Appling and Jeff Davis Counties, and the Little Satilla Creek Watershed in Appling and Wayne Counties in Georgia have been approved for planning by the U. S. Department of Agriculture.

Some attention has been given to the salinity problems of Brunswick and its environs.

"Summary Report on Quality of Interstate Waters—St Marys River"—1957, prepared by the U. S. Public Health Service shows some of the sources of pollution.

The Georgia and Florida State Departments of Health have aided community pollution abatement studies by providing standards and data. The status of waste treatment has been compiled by the U. S. Public Health Service. Public health, as related to land and water resources, has been studied in connection with mosquito-control and water-quality programs. These studies include a "Summary Report on Water Pollution—Southeast Drainage Basins," 1951, a Public Health Service report on stream pollution, based on data provided by South Carolina, Tennessee, Florida, Alabama, Mississippi, and some Georgia data. Some 1955 data have been appended.

The State of Florida has prepared numerous reports on both surface and ground water in Florida. There are also many reports and studies that cover local areas or special problems.

Suwannee Basin

There are no known reports that attempt to portray the entire economy of the Suwannee basin. The Corps of Engineers has prepared reports, dated September 1930, July 1938, and July 1947, that cover flood control, navigation, hydroelectric power, and related aspects of the basin problems and needs. These reports propose no specific development beyond maintenance of the authorized navigation channel for small boats.

The Federal Power Commission prepared a report dated December 1949 on power potentials of the Suwannee-St. Mary-Satilla basins. The report concluded that (1) independent developments were not feasible at the time in any of the basins; (2) the combined development of two or more of the rivers greatly enhances the feasibility and attractiveness of their development; and (3) the plan involving the combined development of the Suwannee, St. Marys, and Satilla Rivers is the best means of developing the water resources of the region and the plan presented warranted detailed study.

A report prepared for the Florida Geological Survey by Abbott, Merkt and Company, Consultants, in 1960, proposes development of small boat access from the Gulf to the Suwannee River.

Ochlockonee Basin

There are no known reports that attempt to portray the entire resources and economy of the Ochlockonee basin. The Corps of Engineers has prepared a number of reports that cover the basin navigation needs. A brief summary of these reports follows:

House Document No. 106, 81st Congress, 1st Session, the River and Harbor Act, dated May 17, 1950, authorized a channel 6 feet deep and 75 feet wide from the Gulf of Mexico to Horseshoe, Florida, and a turning basin of irregular shape and 6 feet deep. The improvement was completed in 1959 and is about 1.75 miles long.

River and Harbor Committee Document No. 87, 74th Congress, 2d Session, dated August 26, 1937, presented a plan for a channel 6 feet deep, 150 feet wide in Deadman Bay, and 100 feet wide in the river from the Gulf of Mexico to Steinhatchee, Florida. The project was completed in 1939 and is about 4.8 miles long.

House Document No. 345, 77th Congress, 1st Session, the River and Harbor Acts of July 3,

1930; August 26, 1937, and March 2, 1945 authorized a channel about 7 miles in length, 10 feet deep, and 100 feet wide from Apalachee Bay to the town of St. Marks, Florida, with a turning basin 200 feet square and 10 feet deep at St. Marks, and removal of snags and similar obstructions in 3 miles of the present channel between St. Marks and Newport, Florida. The project was completed in 1947.

House Document No. 224, 86th Congress, 1st Session, dated August 3, 1959, contains a recommendation of Chief of Engineers to enlarge and modify the existing project at St. Marks, Florida. The recommendations are for a channel 12 feet deep and 125 feet wide in Apalachee Bay to the turning basin at the town of St. Marks generally along the existing channel alignment; a turning basin at St. Marks 12 feet deep and 300 feet square; and a channel 12 feet deep and 100 feet wide extending approximately 3,400 feet upstream from the turning basin.

An investigation of the feasibility of extending the navigation facilities from St. Marks to Tallahassee, Florida was authorized by the River and Harbor Act of 1945 but has not been started.

House Document 184, 70th Congress, 1st Session, and House Document 451, 83d Congress, 2d Session, the River and Harbor Acts of August 26, 1937, and September 3, 1954, respectively, authorized a channel about 4 miles long, 200 feet wide, and 27 feet deep from the Gulf of Mexico to a point west of Dog Island, thence 150 feet wide and 25 feet deep for about 5 miles through St. George Sound and Carrabelle River to a turning basin 500 feet square and 25 feet deep at the town of Carrabelle, Florida, and maintenance of an existing channel 60 feet wide and 8 feet deep extending about 1,200 feet upstream from the head of the turning basin. This project has been completed.

House Document 291, 75th Congress, 1st Session, and House Document 442, 76th Congress, 1st Session, the River and Harbor Acts of August 26, 1937, and March 2, 1945, authorized an extension of the Gulf Intracoastal Waterway. This project would provide a channel 12 feet deep and 125 feet wide from Carrabelle, Florida, via Carrabelle, Crooked, and Ochlockonee Rivers and Ochlockonee and Apalachee Bays to the mouth of St. Marks River, Florida, and a movable span railroad bridge across the Ochlockonee

River near McIntyre, Florida. No construction has been undertaken. The movable span bridge is no longer required because the railroad has been abandoned. This section of the waterway has been deferred in order to investigate the feasibility of an alternate route across St. James Island in lieu of the authorized route. The new investigation was authorized by the House Public Works Committee on August 5, 1957, but has not been started.

An investigation of the need for flood control and related purposes on coastal streams between the Suwannee and Apalachicola Rivers, Florida, was authorized in the Flood Control Act of 1950, but the investigation has not been started.

Authorization for an investigation of the needs for a navigation channel from Panacea, Florida, into Apalachee Bay was made by the 1958 River and Harbor Act. The U. S. Army Engineer District, Mobile, Corps of Engineers, in January 1962 submitted a report to the Division Engineer, South Atlantic Division.

Authority for an investigation of an Intra-coastal Waterway south of St. Marks to Tampa Bay, Florida, was made by Senate Resolution dated February 1940 and by Public Works Committee Resolution dated December 1950. An unfavorable report, based primarily on benefits received from navigation, was submitted by the Jacksonville District Engineer on May 9, 1956. The report was returned April 30, 1959, at the request of local sponsors for further consideration of additional supporting data which they wished to submit. The additional data has not yet been submitted. The report considered a request by local interests essentially for a protected barge channel 12 feet deep and 150 feet wide from St. Marks River southerly for 230 miles to Tampa Bay.

The Public Health Service "Ochlockonee-St. Marks Basin Report" of 1954, contained information on sources of pollution, treatment provided, and abatement needs for the area.

Apalachicola-Chattahoochee-Flint Basins

Few extensive studies have been made of the resources, the economy, or resource problems of the Apalachicola-Chattahoochee-Flint basins.

Both the Corps of Engineers and the Department of Agriculture have submitted reports concerning flood control. The Corps most recent reports on the feasibility of development of the

Apalachicola-Chattahoochee-Flint Rivers are printed in the House Document No. 342, 76th Congress, and in House Document No. 300, 80th Congress. Buford multiple-purpose reservoir, which included storage for flood control, was authorized by Public Law 525, 79th Congress, 2d Session. An unfavorable flood control report was submitted on the Chipola River. A favorable report on Town and Muckalee Creeks recommended improvement of Town Creek by means of channel enlargement and bank clearing. The Town Creek project was authorized and constructed under the provision of Public Law 685, 84th Congress. Ten flood prevention reservoirs have been built under Public Law 566, 83d Congress, as amended, with technical assistance provided by the Soil Conservation Service.

Considerable data are available concerning existing water supply systems and domestic and municipal water supply problems in the Apalachicola-Chattahoochee-Flint basins. Such information compiled by the State Health Departments of Alabama, Florida, and Georgia, and the U. S. Public Health Service was of use in this investigation.

Navigation has been the subject of numerous studies of the Apalachicola-Chattahoochee-Flint Rivers by the Corps of Engineers since 1871. The most recent of these completed studies has resulted in the construction of dams, locks, and supplemental channel work to provide a channel depth of 9 feet for a minimum width of 100 feet on the Apalachicola River and upstream to Columbus, Georgia, on the Chattahoochee and Bainbridge, Georgia, on the Flint.

Consideration was given to the development of hydroelectric power in the Apalachicola-Chattahoochee-Flint basins in studies completed by the Corps of Engineers in 1961 and 1962.

Choctawhatchee-Perdido Basins

Few extensive studies have been made of the resources, the economy, or resource problems of the Choctawhatchee-Perdido basins. However, many specific studies applicable to parts of the area have been made.

Both the Corps of Engineers and the Department of Agriculture have submitted reports on flood control. A previous report was made of the Choctawhatchee River and tributaries. This was a preliminary examination for flood control and allied purposes submitted by the District En-

gineer on November 15, 1943, recommending that no survey report be made since the annual benefits which might accrue from the improvement of the Choctawhatchee River for either flood control or navigation, or a combination of the two would be insufficient to justify the annual cost. A prior report dated June 8, 1931, gave consideration to a plan for flood protection by levees at Elba and Geneva, Alabama, and Caryville, Florida. The report was unfavorable since flood problems for these communities were considered local in scope and did not warrant participation by the Federal Government. The State of Alabama and the Works Progress Administration, however, constructed ring levees around Geneva and Elba, Alabama, in 1938. The levees were constructed 1.8 feet above the 1929 flood at Geneva and 4.3 feet above the same flood at Elba.

Another previous report was made of the Escambia River, Alabama and Florida, a survey report for flood control submitted by the District Engineer on February 3, 1930. The report states that the costs of all the improvements studied would be several times the value of the area to be protected, except the improvements for protecting Brewton and Flomaton, Alabama. While the plans of improvement by ring levees were found to be feasible, the more desirable plan was to move the towns to higher ground and provide plans for their future expansion. Participation in these improvements by the Federal Government was not recommended because benefits were entirely local.

The Corps of Engineers under congressional authorization is currently investigating the need for and feasibility of providing for barge navigation on the Choctawhatchee and Pea Rivers as well as the possibilities of hydropower developments and flood protection on both rivers.

Channel improvements to aid navigation were apparently undertaken by the Federal Government as early as 1833. A summary of navigation acts authorizing navigation improvements follows.

Port St. Joe Harbor is on the northwest coast of Florida on the east shore of St. Joseph Bay, about 115 miles east of Pensacola. St. Joseph Bay extends north and south about 13 miles and averages about 4 miles in width. It is partially landlocked by a narrow peninsula joining

the mainland at the southern end of the bay. The existing project was authorized by the following River and Harbor Acts: (1) House Document 660, 62d Congress, 2d Session, dated July 25, 1912; (2) River and Harbor Committee Document 10, 76th Congress, 1st Session, dated April 26, 1937; (3) Senate Document 17, 77th Congress, 1st Session dated March 2, 1945; and (4) House Document 595, 81st Congress, 2d Session, dated September 3, 1954.

The 1912 project document recommended a width of 350 feet and the act limited the width to 300 feet with a depth of 24 feet across the bar at the entrance to the bay. In 1937 the authorization provided an entrance channel 300 feet wide and 29 feet deep, and a bay channel 200 feet wide and 27 feet deep, with a turning basin at the proposed municipal pier at Port St. Joe. The 1945 authority included adoption of South Channel 27 feet deep and 200 feet wide from bay to turning basin, provision of a 32- x 300-foot entrance channel, a 32- x 200-foot north bay inner channel, and a 32- x 1,000- x 2,000-foot turning basin. The existing project was authorized by the 1954 act.

Panama City Harbor, Florida, is on St. Andrew Bay, a naturally deep body of water about 10 miles long, parallel to the northwest coast of Florida, 105 miles east of Pensacola and 56 miles west of Apalachicola, Florida. The bay is separated from the Gulf by a barrier island known as Hurricane Island. Watson Bayou, a small stream in east Panama City, connects to St. Andrew Bay through an extension known as East Bay. The project was authorized under the following acts. House Document 33, 73d Congress, 1st Session, dated August 30, 1935, authorized channels 27 and 29 feet deep and abandonment of project adopted by act of June 25, 1910. House Document 555, 76th Congress, 3d Session, dated March 2, 1945, provided for maintenance of a channel in Watson Bayou 100 feet wide and 10 feet deep from that depth in St. Andrew Bay to the highway bridges. House Document 559, 80th Congress, 2d Session, dated June 30, 1945, authorized channels 32 and 34 feet deep.

Pensacola Harbor, Florida, is on the north shore of Pensacola Bay, an arm of the Gulf of Mexico, 45 miles east of Mobile Bay and 105 miles west of Panama City. Pensacola Bay is about 13 miles long, $2\frac{1}{2}$ miles wide, and is

separated from the Gulf by the long barrier island of Santa Rosa. The entrance to the bay is through a pass at the western end of the island. The existing project for Pensacola Harbor was authorized by the River and Harbor Act of March 2, 1945, House Document 743, 79th Congress, 2d Session, and previous acts and the Act of 1962, House Document 528, 87th Congress. On June 13, 1902, a channel 30 feet deep at mean low water and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola, and also provided that \$150,000 may be used in constructing or purchasing a sea-going suction dredge. House Document 253, 72d Congress, 1st Session, dated August 30, 1935, modified the existing project to provide for the present inner channels and the deepening of the entrance channel to 32 feet.

House Committee Document 96, 74th Congress, 2d Session, dated February 19, 1936, provided for channel from Bayou Chico into Pensacola Bay.

The Gulf Intracoastal Waterway provides a protected route for barge traffic and small craft from Brownsville, Texas, to St. Marks, Florida, a total distance of 1,120 miles. The route extends through tidal bays, marshes, improved river channels, and land cuts, and contains six locks in the section between New Orleans, Louisiana, and Port Arthur, Texas. Minimum dimensions of the waterway between New Orleans and Brownsville are 12 by 125 feet; between New Orleans, Louisiana, and Mobile, Alabama, 12 by 150 feet; and between Mobile, Alabama, and St. Marks, Florida, 12 by 125 feet. The existing project for the Gulf Intracoastal Waterway was authorized by the following River and Harbor Acts: Public Law 675, 77th Congress, and House Document 96, 79th Congress, 1st Session, dated July 23, 1942, authorized a channel 12 feet deep and 125 feet wide at mean low water, from Apalachee Bay, Florida, to New Orleans, Louisiana, except in the section between Mobile, Alabama, and New Orleans, Louisiana, where width is to be 150 feet.

House Document 257, 76th Congress, 1st Session and Public Law 75, 78th Congress, 1st Session, dated June 17, 1943, provided conditional acquisition of Gulf County Canal, Florida, and enlargement of the canal to 9 feet deep and 100 feet wide. House Document 442, 76th Congress, 1st Session, dated March 2, 1945, authorized

construction of a movable span in the Georgia, Florida, and Alabama railroad bridge crossing the Ochlockonee River. House Document 325, 81st Congress, 1st Session, dated May 17, 1950, provided abandonment and closure of original channel between Big Lagoon and Pensacola Bay and construction of a new channel to enter the bay north of original entrance.

East Pass Channel, Florida, is the natural inlet from the Gulf of Mexico into Choctawhatchee Bay at the eastern end of Santa Rosa Island, Florida. It is 48 miles east of the entrance into Pensacola Bay and 60 miles west of the entrance to St. Andrew Bay. The existing project for East Pass consists of a channel 12 feet deep at mean low water, 180 feet wide, and about 3 miles long from Choctawhatchee Bay into the Gulf of Mexico, and a side channel 6 feet deep, 100 feet wide, and about 2,000 feet long from the East Pass Channel into Old Pass Lagoon. The existing project was adopted by Public Law 193, 82d Congress, 1st Session, approved October 24, 1951, and a prior act. The terminal facilities located in the immediate vicinity of East Pass consist of pile and timber wharves and piers and a marine ways which serve the recreational and charter fishing fleet based in Old Pass Lagoon.

La Grange Bayou, an arm of Choctawhatchee Bay, is in Walton County, Florida, about 65 miles east of Pensacola and 45 miles west of Panama City. It branches from the north shore of Choctawhatchee Bay about 5.5 miles from its eastern end and extends north about 3.5 miles to the head of navigation at Freeport, Florida. The Federal project provides for a channel 12 feet deep and 100 feet wide from the 12-foot depth contour in Choctawhatchee Bay to Freeport, Florida, and a turning basin 12 feet deep, 200 feet wide, and 400 feet long at Freeport. The existing project was authorized by the River and Harbor Act of May 17, 1960, House Document 190, 81st Congress, 1st Session, and previous acts. Terminal facilities at Freeport consist of small craft wharves and landings and storage facilities for petroleum products and molasses.

Several U. S. Public Health Service reports and reports from Alabama and Florida State agencies were reviewed and information obtained on water pollution, public water supplies, water quality, radiological sampling activities, and related data.

APPENDIX 13

PLAN FOR DEVELOPMENT
OF THE
LAND AND WATER RESOURCES
OF THE
SOUTHEAST RIVER BASINS

**HISTORY AND ORGANIZATION
OF THE COMMISSION**

APPENDIX 13

TO REPORT OF
**UNITED STATES STUDY COMMISSION
SOUTHEAST RIVER BASINS**

1963

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HOWARD W. CHAPMAN , Health, Education, and Welfare	LESTER S. MOODY Georgia
WALTER A. GRESH Interior	ROBERT C. PRICE Federal Power Commission

FORMER COMMISSIONERS

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Maj. Gen., Army
Vice Chm.—Resigned, June 1960

THOMAS A. JOHNSON
Florida
Deceased, March 1961

JOHN A. SHORT
Agriculture
Resigned, June 1961

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Executive Director

HARRY W. ADAMS
*Assistant Executive
Director*

FRED H. LARSON
Special Assistant

RICHARD F. BECKMAN
Administrative Assistant

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Mark V. Hughes, Jr.
Paul H. Shore
Alva J. Armstrong
Kenneth C. Bird
Orville W. Chinn
Joseph T. Gay, Jr. # #
G. Robert Hallø
Richard L. Larkin
George R. Phippen
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Joseph T. Gay, Jr. # #
Burle C. Laton
Horace P. Morgan
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Albert H. Spector
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Lewis A. Young**

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ROGER J. PARKER
Ronald E. Anderson*
W. Kenneth Calhoun*
Thomas L. Hughes*
William M. Wilson*

HYDROLOGY

WALTER T. WILSON
Donald E. Whelan # #
Roy W. Mitchell, Jr.*
Karl H. Rossoll

Assignments at completion of work.

Dual concurrent assignment.

* Served less than 18 months.

** On long-term loan from another agency.

o Deceased April 1962.

øø Deceased January 1963.

FOREWORD

This Appendix documents the history and organization of the United States Study Commission, Southeast River Basins. It recounts the activities relating to the Commission preceding the initial meeting held on January 12, 1959, until the completion of the Commission Report.

This Appendix is presented in four parts. Part One sets forth the authorizing legislation, Public Law 85-850; the Flood Control Act of 1944; and the directives from the Executive Branch concerning Commission responsibilities, policies, and procedures. Part Two describes the Commission staff organization and assignments. Part Three summarizes the objectives and principal planning concepts and procedures used in the studies, while Part Four presents the coordination efforts of the Commission involved in planning and executing the study, including major policy decisions and the public relations contacts and followthrough.

The Report presents a plan made in response to the provisions of Public Law 85-850 (72 Stat. 1090), dated August 28, 1958, which established the United States Study Commission, Southeast River Basins. The authorizing Act provides for an integrated and cooperative investigation to formulate a comprehensive and coordinated plan for:

- (1) Flood control and prevention;
- (2) domestic and municipal water supplies;
- (3) the improvement and safeguarding of navigation;
- (4) the reclamation and irrigation of land, including drainage;
- (5) possibilities of hydroelectric power and industrial development and utilization;
- (6) soil conservation and utilization;
- (7) forest conservation and utilization;
- (8) preservation, protection, and enhancement of fish and wildlife resources;
- (9) the development of recreation;
- (10) salinity and sediment control;

- (11) pollution abatement and the protection of public health; and
- (12) other beneficial and useful purposes not enumerated in the Act.

Under item (12), special studies were made of beach erosion and hurricanes and low-flow augmentation.

The comprehensive plan for the Southeast River Basins is formulated to meet the projected needs of the area for land and water resources development to the year 2000. Projects and programs existing and under construction in 1960 are included in the plan, but only 1960-2000 developments are analyzed.

The plan for the development of the resources of the Southeast River Basins is the result of cooperative work of Federal, State, and local and private agencies and individuals having interest in the area and knowledge of its needs and requirements. Public hearings were held early in the planning process to obtain firsthand knowledge of conditions and problems in the study area and to secure suggestions for their solution. Throughout the study, liaison was maintained with interested groups, agencies, and individuals by means of conferences and committee and advisory group meetings. When a preliminary plan was developed, public presentations were made by the Commission to inform interested persons and organizations and to request comments. These comments were considered in preparing the final plan and Report.

Although many individuals, groups, and agencies have participated in the studies, the Commission takes full responsibility for the plan and for the projections, assumptions, and analyses on which it is based.

The Commission plan for the Southeast River Basins is supported by data contained in 13 appendixes. Data on the plan for development of the resources in the eight geographic areas studied in the Southeast River Basins are contained in Appendixes 1 through 8. Technical data and information applicable to both the entire study area and several components are contained in Appendixes 9 through 13. The

Appendices to the Commission Report are as follows:

Appendix	Title
1	Savannah Basin
2	Ogeechee Basin
3	Altamaha Basin
4	Satilla-St. Marys Basins
5	Suwannee Basin
6	Ochlockonee Basin
7	Apalachicola-Chattahoochee- Flint Basins

Appendix	Title
8	Choctawhatchee-Perdido Basins
9	Economics
10	Hydrology
11	Engineering and Cost
12	Planning
13	HISTORY AND ORGANIZATION OF THE COMMISSION

**U. S. STUDY COMMISSION
SOUTHEAST RIVER BASINS**

APPENDIX 13
HISTORY AND ORGANIZATION OF THE COMMISSION
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PART ONE - THE COMMISSION

SECTION I - BACKGROUND AND ORIGIN

On June 16, 1958, Senator Richard B. Russell of Georgia introduced a bill, S. 4021, to establish the U. S. Study Commission. It was cosponsored by Senator Herman Talmadge of Georgia, Senators Olin D. Johnston and Strom Thurmond of South Carolina, Senators Lister Hill and John J. Sparkman of Alabama, and Senators Spessard L. Holland and George A. Smathers of Florida.

The bill, which read, "to establish the United States Study Commission on the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Alabama-Coosa River Basins, and intervening areas," was referred to the Senate Committee on Public Works.

Representatives Erwin Mitchell and Iris F. Blitch of Georgia introduced in the House of Representatives on July 1, 1958, and July 23, 1958, respectively, bills H.R. 13232 and H.R. 13516, identical in language to S. 4021, to establish the Commission. Both of these measures were sent to the House Committee on Public Works. No further action was taken on either of these House bills, as such, because S. 4021 was approved by the Senate and sent to the House early in August 1958.

The Senate, on July 29, 1958, heard a report on S. 4021 by Senator Dennis Chavez, Chairman of the Public Works Committee, suggesting amendments to the original bill and including comments by the Bureau of the Budget.

On August 1, 1958, Senator Lyndon B. Johnson of Texas moved consideration of the bill to establish the U. S. Study Commission, agreeing to a number of amendments resulting from views expressed by both the Bureau of the Budget and the Senate Committee. Some of the amendments were merely word changes; others were more substantive such as the addition of a Commission member from the Department of the Interior and granting the President 90 days following receipt of the final Report in which to make a review before he transmits it to the Congress with his views, comments, and recommendations. The latter amendment was suggested by the Bureau of the Budget. At this

point on August 1, 1958, the Senate approved S. 4021, and it was sent to the House for action.

On August 13, 1958, Representative Clifford Davis of Tennessee presented to the House a report by the Public Works Committee, recommending passage of S. 4021 with an amendment in the title and throughout the Act. The proposed amendment provided for the deletion of the Alabama-Coosa River basins and the substitution of the Perdido-Escambia River basins. In the report to the House, Representative Davis explained that views of the Bureau of the Budget had been carried out in the Senate amendments. At the same time, he spoke of the value of commissions in the future development of land and water resources and cited such previous studies as those of the New York-New England area and the Arkansas-White-Red Basins area.

The House, on August 15, 1958, again with Representative Clifford Davis of Tennessee noting the Public Works Committee amendments, approved S. 4021 as amended and returned the bill to the Senate for approval.

When the presiding officer laid before the Senate on August 19, 1958, the amendments approved by the House to S. 4021, Senator Russell moved the Senate concur in these amendments and the motion was agreed to, leading to final passage of the bill.

Public Law 85-850 was passed unanimously by both houses and had the active support of the House and Senate delegations from the Southeast.

On August 28, 1958, President Eisenhower signed into law S. 4021, which became Public Law 85-850 (72 Stat. 1090) —an Act to establish the U. S. Study Commission on the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins, and intervening areas.

Because of the inconvenience of the long title, the Commission, on February 2, 1959, decided to shorten its name subject to the approval of the Appropriations Committees and of the Congress. At the hearings on the Fiscal Year 1960 appro-

priations, both the House and Senate Appropriation Committees were informed of the desire to shorten the name of the Commission to United States Study Commission, Southeast River Basins. The regular appropriations for

Fiscal Year 1960 and each of the following years were made by the Congress, with the concurrence of the Bureau of the Budget, in the name of "The United States Study Commission, Southeast River Basins."

SECTION II - AUTHORITY

**Public Law 85-850
85th Congress, S. 4021
August 28, 1958
AN ACT**

72 Stat. 1090.

To establish the United States Study Commission on the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins, and intervening areas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the purpose of this Act is —

(a) to provide for an integrated and cooperative investigation, study, and survey by a commission created pursuant to this Act and composed of representatives of certain departments and agencies of the United States, and of certain States enumerated in this section, in connection with, and in promotion of, the conservation, utilization, and development of the land and water resources of the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins (and intervening areas) in the States of South Carolina, Georgia, Florida, and Alabama in order to formulate a comprehensive and coordinated plan for—

- (1) flood control and prevention;
- (2) domestic and municipal water supplies;
- (3) the improvement and safeguarding of navigation;
- (4) the reclamation and irrigation of land, including drainage;
- (5) possibilities of hydroelectric power and industrial development and utilization;
- (6) soil conservation and utilization;
- (7) forest conservation and utilization;
- (8) preservation, protection, and enhancement of fish and wildlife resources;
- (9) the development of recreation;
- (10) salinity and sediment control;
- (11) pollution abatement and the protection of public health; and
- (12) such other beneficial and useful purposes not herein enumerated; and

(b) to formulate, within the time provided for in section 9 of this Act, a basic, comprehensive and integrated plan of development of the land and water resources within the area described in this section for submission to, and consideration by, the President and the Congress, and to make recommendations, after adequate study, for executing and keeping current such plan. It is not the purpose of this Act to create

any continuing or permanent instrumentality of the Federal Government or to take from, or reassign, the duties and powers of any department or agency of the United States represented on the Commission, except as herein provided in this Act.

SEC. 2. In carrying out the purposes of this Act it shall be the policy of Congress to—

- (1) recognize and protect the rights and interest of the States in determining the development of the watersheds of the rivers herein mentioned and their interests and rights in water utilization and control, as well as the preservation and protection of established uses;
- (2) protect existing and authorized projects and projects under construction whether public or private;
- (3) utilize the services, studies, surveys, and continuing investigational programs of the departments, bureaus, and agencies of the United States;
- (4) recognize an important body of existing Federal law affecting the public lands, irrigation, reclamation, flood control, grazing, geological survey, national parks, mines, and minerals; and

(5) to recognize the primary responsibilities of the States and local interests in developing water supplies for domestic, municipal, industrial, and other purposes and that the Federal Government should participate and cooperate with States and local interests in developing such water supplies in connection with the construction, maintenance, and operation of Federal navigation, flood control, irrigation, or multiple purpose projects.

SEC. 3. (a) In order to carry out the purposes of this Act, there is hereby established a commission to be known as the United States Study Commission on the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins and intervening areas (hereinafter referred to as the "Commission").

(b) The Commission shall be composed of eleven members appointed by the President as follows:

(1) One member, who shall serve as Chairman, and who shall be a resident from the area comprising the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins (and intervening areas) embraced within the States referred to in the first section of this Act and who shall not, during the period of his service on the Commission, hold any other position as an officer or employee of the United States, except that a retired military officer or a retired Federal civilian officer or employee may be appointed under this Act without prejudice to his retired status, and he shall receive compensation as authorized herein in addition to his

retired pay or annuity, but the sum of his retired pay or annuity and such compensation as may be payable hereunder shall not exceed \$12,000 in any one calendar year;

(2) Six members, of whom one shall be from the Department of the Army, one from the Department of Commerce, one from the Department of Health, Education, and Welfare, one from the Department of Agriculture, one from the Department of Interior, and one from the Federal Power Commission; and

(3) Four members, upon the recommendation and nomination, subject to the provisions of subsection (c) of this section, of the respective governors of each of the following States: South Carolina, Georgia, Florida, and Alabama.

(c) In the event of the failure of the governor of any of the States referred to in subsection (b) of this section to recommend and nominate a person or persons in accordance with the provisions of paragraph (3) of subsection (b) of this section satisfactory to the President within sixty days after a request by the President for such recommendation and nomination, the President shall then select and appoint a qualified resident from such State which failed to submit a satisfactory recommendation and nomination.

(d) Any vacancy in the Commission shall not affect its powers but shall be filled in the same manner in which the original appointment was made.

(e) Within thirty days after the appointment of the members of the Commission by the President, and funds have been made available by the Congress as provided for in this Act, the Commission shall organize for the performance of its functions.

(f) The Commission shall elect a Vice Chairman from among its members.

(g) Six members of the Commission, of whom at least three shall have been appointed pursuant to subsection (b) (3) or (c) of this section, shall constitute a quorum for the transaction of business.

(h) Members of the Commission shall report from time to time to their respective departments or agencies, or to their respective governors if appointed pursuant to subsection (b) (3) or (c) of this section, on the work of the Commission, and any comments and suggestions pertaining to such work from such departments, agencies, or governors shall be placed before the Commission for its consideration.

(i) The Commission shall cease to exist within three months from the date of its submission to the President of its final report as provided for in section 9 of this Act. All property, assets, and records of the Commission shall thereupon be turned over for liquidation and disposition to such agency or agencies in the executive branch as the President shall designate.

SEC. 4. The Commission may, for the purpose of carrying out the provisions of this Act, hold such hearings, sit and act at such times and places, take such testimony, administer such oaths, and publish so much of its proceedings and the reports thereon as it may deem advisable; lease, furnish, and equip such office space in the District

of Columbia and elsewhere as it may deem necessary; use the United States mails in the same manner and upon the same conditions as Departments and agencies of the United States Government; have printing and binding done in its discretion by establishments other than the Government Printing Office; employ and fix the compensation of such personnel as it deems advisable, without regard to the provisions of the civil service laws and the Classification Act of 1949, as amended; purchase or hire, operate, maintain, and dispose of such vehicles as it may require; secure directly from any executive department, bureau, agency, board, commission, office, independent establishment, or instrumentality, information, suggestions, estimates, and statistics for the purpose of this Act; and each such department, bureau, agency, board, commission, office, establishment, or instrumentality is authorized to furnish such information, suggestions, estimates, and statistics directly to the Commission, upon request made by the Chairman or Vice Chairman, and employees of the departments or agencies from which persons have been appointed to the Commission pursuant to section 3 (b) (2) of this Act may be assigned upon request by the Chairman of the Commission to temporary duty with the Commission without loss of seniority, pay, or other employee status; pay travel in accordance with standardized Government Travel Regulations and other necessary expenses incurred by it, or any of its officers or employees, in the performance of duties vested in such Commission; and exercise such other powers as are consistent with and reasonably required to perform the functions vested in such Commission under this Act.

SEC. 5. Responsibility shall be vested in the Chairman for (1) the appointment and supervision of personnel employed under the Commission, (2) the distribution of business among such personnel, and (3) the use and expenditure of funds: *Provided*, That in carrying out his functions under the provisions of this section, the Chairman shall be governed by the general policies of the Commission.

SEC. 6. (a) Members of the Commission appointed pursuant to section 3 (b) (2) of this Act shall receive no additional compensation by virtue of their membership on the Commission, but shall continue to receive the salary of their regular position when engaged in the performance of the duties vested in the Commission. Such members shall be reimbursed for travel, subsistence, and other necessary expenses incurred by them in the performance of the duties vested in the Commission.

(b) Members of the Commission, other than those appointed pursuant to section 3 (b) (2) of this Act, shall each receive compensation at the rate of \$50 per day when engaged in the performance of duties vested in the Commission, plus reimbursement for travel, subsistence, and other necessary expenses incurred by them in the performance of such duties, but the aggregate compensation received by the members of the Commission pursuant to this subsection shall not exceed \$12,000 per annum in the case of the Chairman, and \$7,500 per annum in the case of members of the Commission other than those members appointed pursuant to section 3 (b) (2) of this Act.

SEC. 7. In the formulation of a comprehensive and co-

ordinated plan or plans for (a) the control, conservation, and utilization of the waters of the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins (and intervening areas), (b) conservation and development of the land resources of such area; (c) flood control, navigation, reclamation, agriculture purposes, power, recreation, fish and wildlife, and (d) such other needs as are set forth in paragraph (a) of the first section of this Act, the Commission shall —

(1) seek to secure maximum public benefits for the region and the Nation consistent with the specific directions contained in section 8 and elsewhere in this Act;

(2) utilize the services, studies, surveys, and reports of existing Government agencies and shall encourage the completion of such current and additional studies and investigations by such agencies as will further the purposes of this Act, and such agencies are authorized to cooperate within the limits of available funds and personnel to the end that the Commission may carry out its functions as expeditiously as possible;

(3) take into consideration the financial, physical, and economic benefits of existing and prospective Federal works constructed or to be constructed consistent with the purposes of this Act;

(4) include in its plan or plans estimated costs and benefits; recommendations relating to the establishment of pay-out schedules (areawide or otherwise) taking into account the Federal Government's present and prospective investment in the area; costs reimbursable and nonreimbursable; sources for reimbursement; returns heretofore made from existing projects and estimates of returns from recommended projects; repayment schedules for water, irrigation, industrial, and other uses; power rates and recommendations for the marketing thereof in such manner as to encourage its most widespread use at the lowest possible rates consistent with the return of capital investment and interest thereon; and

(5) offer in its plan or plans proposals for the construction and operation of the projects contained therein, and designate the functions and activities of the various Federal departments and agencies in connection therewith consistent with existing law, except that no such plan or plans shall include final project designs and estimates.

SEC. 8. In the formulation of its plan or plans and in the preparation of its report to the President and to the Congress, the Commission shall comply with the following directives:

(1) The report shall contain the basic comprehensive plan for the development of the water and land resources of the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins (and intervening areas) formulated by the Commission in accordance with the provisions of, and to accomplish the purposes of, this Act;

(2) The Commission and the participating Federal departments and agencies shall comply substantially with the intent, purposes, and procedure set forth in the first section of the Act entitled "An Act authorizing the con-

struction of certain public works on rivers and harbors for flood control and other purposes", approved December 22, 1944 (58 Stat. 887).

SEC. 9. (a) The Commission is authorized and directed to prepare a final report, within the time provided for in this section, for submission to the President. Before the Commission takes final action on the approval of such report for submission to the President, it shall transmit a copy of such report to each department, agency, and governor referred to in subsection (b) of section 3 of this Act. Within ninety days from the date of receipt by each such department, agency, and governor of such proposed report, the written views, comments, and recommendations of such department, agency, and governor shall be submitted to the Commission. The Commission may adopt in its report to the President any views, comments, and recommendations so submitted and change its report accordingly. The Commission shall transmit to the President, with its final report, the submitted views, comments, and recommendations of each such department, agency, and governor whether or not adopted by such Commission.

(c) The President shall, within ninety days after the receipt by him of the final report of the Commission, transmit it to Congress with his views, comments, and recommendations.

(d) The final report of the Commission and its attachments shall be printed as a House or Senate document.

SEC. 10. There are hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, such sums as may be required to carry out the purposes of this Act.

Approved August 28, 1958.

FLOOD CONTROL ACT OF 1944

Section 8 of Public Law 85-850 provides that, "The Commission and the participating Federal departments and agencies shall comply substantially with intent, purposes, and procedures set forth in the first section" of the Flood Control Act, approved December 22, 1944 (58 Stat. 887). The pertinent section is quoted in the following text:

AN ACT

Authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, In connection with the exercise of jurisdiction over the rivers of the Nation through the construction of works of improvement, for navigation or flood control, as herein authorized, it is hereby declared to be the policy of the Congress to recognize the interests and rights of the States in determining the development of watersheds within their borders and likewise their interests and rights in water utilization and control, as herein authorized to preserve and protect to the fullest possible extent established and potential uses, for all purposes, of the waters

of the Nation's rivers; to facilitate the consideration of projects on a basis of comprehensive and coordinated development; and to limit the authorization and construction of navigation works to those in which a substantial benefit to navigation will be realized therefrom and which can be operated consistently with appropriate and economic use of the waters of such rivers by other users.

In conformity with this policy:

(a) Plans, proposals, or reports of the Chief of Engineers, War Department, for any works of improvement for navigation or flood control not heretofore or herein authorized, shall be submitted to the Congress only upon compliance with the provisions of this paragraph (a). Investigations which form the basis of any such plans, proposals, or reports shall be conducted in such a manner as to give to the affected State or States, during the course of the investigations, information developed by the investigations and also opportunity for consultation regarding plans and proposals, and, to the extent deemed practicable by the Chief of Engineers, opportunity to cooperate in the investigations. If such investigations in whole or part are concerned with the use or control of waters arising west of the ninety-seventh meridian, the Chief of Engineers shall give to the Secretary of the Interior, during the course of the investigations, information developed by the investigations and also opportunity for consultation regarding plans and proposals, and to the extent deemed practicable by the Chief of Engineers, opportunity to cooperate in the investigations. The relations of the Chief of Engineers with any State under this paragraph (a) shall be with the Governor of the State or such official or agency of the State as the Governor may designate. The term "affected State or States" shall include those in which the works or any part thereof are proposed to be located; those which in whole or part are both within the drainage basin involved and situated in a State lying wholly or in part west of the ninety-eighth meridian; and such of those which are east of the ninety-eighth meridian as, in the judgment of the Chief of Engineers, will be substantially affected. Such plans, proposals, or reports and related investigations shall be made to the end, among other things, of facilitating the coordination of plans for the construction and operation of the proposed works with other plans involving the waters which would be used or controlled by such proposed works. Each report submitting any such plans or proposals to the Congress shall set out therein, among other things, the relationship between the plans for construction and operation of the proposed works and the plans, if any, submitted by the affected States and by the Secretary of the Interior. The Chief of Engineers shall transmit a copy of his proposed report to each affected State, and, in case the plans or proposals covered by the report are concerned with the use or control of waters which rise in whole or in part west of the ninety-seventh meridian, to the Secretary of the Interior. Within ninety days from the date of receipt of said proposed report, the written views and recommendations of each affected State and of the Secretary of the Interior may be submitted to the Chief of Engineers. The Secretary of War shall transmit to the Congress, with such comments and recommendations as he deems appropriate, the proposed report to-

gether with the submitted views and recommendations of affected States and of the Secretary of the Interior. The Secretary of War may prepare and make said transmittal any time following said ninety-day period. The letter of transmittal and its attachments shall be printed as a House or Senate document.

(b) The use for navigation, in connection with the operation and maintenance of such works herein authorized for construction, of waters arising in States lying wholly or partly west of the ninety-eighth meridian shall be only such use as does not conflict with any beneficial consumptive use, present or future, in States lying wholly or partly west of the ninety-eighth meridian, of such waters for domestic, municipal, stock water, irrigation, mining, or industrial purposes.

(c) The Secretary of the Interior, in making investigations of and reports on works for irrigation and purposes incidental thereto shall, in relation to an affected State or States (as defined in paragraph (a) of this section), and to the Secretary of War, be subject to the same provisions regarding investigations, plans, proposals, and reports as prescribed in paragraph (a) of this section for the Chief of Engineers and the Secretary of War. In the event a submission of views and recommendations, made by an affected State or by the Secretary of War pursuant to said provisions, sets forth objections to the plans or proposals covered by the report of the Secretary of the Interior, the proposed works shall not be deemed authorized except upon approval by an Act of Congress; and subsection 9 (a) of the Reclamation Project Act of 1959 (53 Stat. 1187) and subsection 3 (a) of the Act of August 11, 1939 (53 Stat. 1418), as amended, are hereby amended accordingly.

Presidential Letter and Guide

By letter, dated December 16, 1958, President Dwight D. Eisenhower informed Mr. J. W. Woodruff, Jr. of his appointment as Chairman of the U. S. Study Commission, Southeast River Basins, and provided a guideline statement to assist the Commission in its organization efforts and in its consideration of study objectives, policies, and procedures.

The text of this guideline statement follows:

Guide for the U. S. Study Commission on the Savannah, Altamaha, Saint Marys, Apalachicola-Chattahoochee, and Perdido-Escambia River Basins, and Intervening Areas

Background

Many problems arise in connection with the planning, development, control, and use of our water and land resources. One of the greatest problems encountered in past attempts to provide comprehensive planning has been the difficulty in coordinating the plans of Federal agencies with each other and with States and local interests. Various devices have been attempted to achieve

broad, fully integrated water and land resources planning through existing agency patterns.

The U. S. Study Commission is an outgrowth of the experience gained in previous efforts to obtain overall, integrated plans. It provides a new, untried form of organization to overcome past problems. It offers a challenging opportunity for the formulation of sound, comprehensive, coordinated plans for water and land development. The law establishing the Commission permits all functions and purposes to be considered impartially and objectively; provides for adequate consideration of the economic needs of the region and the Nation; protects existing and authorized projects and projects under construction, whether public or private; and contemplates a collaborative approach to planning where the voice of each interest, Federal, State, and local, public or private, may be heard and considered. The law also states that it shall be the policy of the Congress to recognize the rights and interests of the States in determining the development of the watersheds of their rivers as well as existing Federal law in the field of resources development; to utilize the continuing investigational programs of Federal agencies; to recognize the primary responsibility of the States and local interests in developing water supplies for domestic, municipal, industrial and other purposes; and that it is not its purpose to take from or reassign the duties and powers of any Federal department or agency except as provided in the Act.

Responsibility of Commission

1. It should be kept in mind that the Commission is an independent Federal agency whose members are appointed by the President. Members will keep their respective agencies and States informed of the progress of the studies and may place before the Commission any comments and suggestions from their respective national responsibility and will be accountable to the President when performing the duties of the Commission. During the periods of their service on the Commission, they are Federal officials subject to the regulations, rules of conduct, and laws of the United States.

2. The Commission will report to the President through the Special Assistant for Public Works Planning.¹

3. The Chairman of the Commission will be responsible for keeping the President's Assistant for Public Works Planning¹ fully informed as work progresses, especially as to emerging issues or alternatives touching on Federal policies, programs, and organizations.

4. The Commission should time the submission of any reports, analyses, recommendations, and drafts in a manner which would avoid a last minute rush to obtain necessary Washington clearances.

5. The objective of the Commission will be to provide for an integrated and cooperative investigation, study, and survey in order to formulate a comprehensive and coordinated plan as set forth in Public Law 85-850. Plans should be developed in such a manner as will assure optimum, sustained use of the resources of the region in the light of its overall economic requirements, and secure their maximum contribution to the economic growth, strength, and general welfare of the region as well as the Nation.

It will be the duty of the Commission to assure that the complete range of views and desires of Federal, State, and local governments as well as of non-public interests are carefully considered.

6. In the designation of the functions and activities of the various Federal Departments and agencies, in connection with the proposed plan as required by Sec. 7 of Public Law 85-850, consideration should be given to the question as to whether the program, feature, or facility can be more effectively and economically financed, constructed and operated by a non-Federal entity.

7. The Commission is referred to Budget Bureau Bulletin A-47 as well as the report of the Presidential Advisory Committee on Water Resources Policy, which was transmitted by the President to the Congress on January 17, 1956, as guides to Administration position on policies and evaluation procedures. Also to be considered, are the current practices and procedures of the several Federal agencies in their presentations to the Congress for authorization of works of improvement. The report of the President's Water Resources Policy Commission, entitled "A Water Policy for the American People," contains a good approach to the formulation of policies and long-range plans for the regional development of water and related land resources. The attention of the Commission is also drawn to Senate Resolution 148, 85th Congress, which requests certain information to be furnished the Senate Committees concerned with water and land resources development reports.

Relationships with Federal, State, and Local Agencies

1. The Special Assistant to the President for Public Works Planning¹ will, in addition to briefing the Commission at the time it is organized, and arranging for such administrative services as may be required, assist it when policy or other important issues arise by:

(a) Arranging for such meetings as may be needed from time to time with Federal agencies in Washington;

(b) Coordinating agency views and performing necessary clearances at the Washington level;

(c) Ascertaining the position of the President on any matters that arise on which his decision is required.

2. Maximum use should be made of basic data available from Federal, State and local agencies. Information available from regular agency programs should be obtained by the Commission without cost. Whenever special studies are required by the Commission, they should, wherever practicable, be performed by one of these agencies on a reimbursable basis. Efforts should be made to secure maximum coordination between Commission and agency programs.

¹ Amended by letter of January 30, 1961, addressed to the Chairman, and signed by the Deputy Director of the Bureau of the Budget, reading, in part, "In view of the transfer of functions of the White House Public Works Planning Unit to the Bureau of the Budget, the point of contact within the Executive Office for the U. S. Study Commission-Southeast River Basins will hereafter be the Director, Bureau of the Budget."

3. The following Federal Departments and agencies will normally have an interest in the investigation and survey being conducted by the Study Commission.

- (a) Bureau of the Budget
- (b) Department of Agriculture
- (c) Department of the Army
- (d) Department of Commerce
- (e) Department of Health, Education, and Welfare
- (f) Department of the Interior
- (g) Department of Justice
- (h) Department of Labor
- (i) Federal Power Commission

All of these agencies may be called upon for information and advice, either through their Washington offices, or through their designated field officials, as authorized by Public Law 85-850. Requests for assistance from the Federal agencies will normally be directed to the field officials of the agencies who are responsible in the study area.

Reporting and Procedural Requirements

1. The U. S. Study Commission shall submit quarterly status reports to the President through the Special Assistant for Public Works Planning¹, including copies of

¹ See footnote on page 1-6.

official minutes and completed reports or significant sections thereof.

2. The Commission should identify all emerging issues, giving State and agency views, where applicable, either in the quarterly status reports or separately as the need arises. The Chairman, in the presentation of such information, should include his own analyses and recommendations on such issues.

Administrative

1. Public Law 85-850 sets forth the authorizations of the Commission for employment and other administrative operations.

2. The Commission should immediately develop its proposed program and organization for the current and budget years and submit promptly to the Bureau of the Budget its estimates of appropriation requirements in order that the Budget document for 1960 may adequately reflect the proposed program. Arrangements should also be made for early recruitment of Commission staff.

3. Enclosed is a copy of Budget Bureau Bulletin A-11, Revised, dated June 27, 1958, Subject, "Instructions for the Preparation and Submission of Annual Budget Estimates."

SECTION III – COMMISSION MEMBERS

By December 16, 1958, recommendations and nominations for the original membership on the Commission had been made by the Federal Departments and the Governors of each of the four States; and on this date, President Dwight D. Eisenhower made the initial appointments. During the course of the studies, there were several changes in Commission membership. Membership on the Commission at the end of the studies includes:

JAMES W. WOODRUFF, JR., Chairman, appointed December 16, 1958; native of Columbus, Georgia; active in the broadcasting industry as well as other business interests; President and Chairman of the Board of Columbus Broadcasting Company; Director, First National Bank, Columbus; Executive Director, Georgia Waterways Commission since its organization in December 1953; active participant in development of the Apalachicola-Chattahoochee-Flint Rivers; Past President, Chambers of Commerce, Columbus; Recipient of Distinguished Citizen Award, Columbus, 1942; Trustee of University of Georgia Foundation, Joint Tech-Georgia Development Fund, and Trinity School; resides in Columbus, Georgia.

Nominated by the Governor of Alabama

RALPH C. HAMMOND, Commissioner from the

State of Alabama; appointed December 16, 1958; native of DeKalb County, Alabama; served as Press Secretary and Executive Secretary to former Governor James Folsom; also served as a member of the Alabama Highway Authority and Acting Director of Alabama State Docks and Terminals; cotton broker; resides in Arab, Alabama.

Nominated by the Governor of Florida

TOM ADAMS, Commissioner from the State of Florida, appointed May 3, 1961, to succeed Commissioner Johnson; native of Jacksonville, Florida; active in Florida politics as a member of Florida Senate; elected Florida Secretary of State in November 1960; timber operator; resides in Tallahassee, Florida.

Nominated by the Governor of Georgia

LESTER S. MOODY, Commissioner from the State of Georgia, appointed December 16, 1958; native of Ocala, Florida; served as Manager of the Augusta Chamber of Commerce; active in navigation development on the Savannah River; Board Member, Rivers and Harbors Congress; resides in Augusta, Georgia.

Nominated by the Governor of South Carolina

JAMES H. HAMMOND, Commissioner from the State of South Carolina, appointed December

16, 1958; native of Barnwell County, South Carolina; has served in both the House and Senate of South Carolina; has served as Chairman of the State Ports Authority and the South Carolina Public Service Authority; serves as Chairman of the Board, Security Federal Building and Loan Association, Columbia, South Carolina, where he resides.

Appointed from Federal Agencies

CECIL W. CHAPMAN, Commissioner from Department of Agriculture; appointed June 28, 1961, to succeed Commissioner Short; native of Emanuel County, Georgia; entered Federal service with Department of Agriculture in 1933; currently State Conservationist, Soil Conservation Service, Athens, Georgia; resides in Athens.

HOWARD A. MORRIS, Commissioner from the Department of the Army; appointed August 26, 1960; native of Aurora, Nebraska; Brigadier General, U. S. Army; Division Engineer, South Atlantic, Corps of Engineers, Atlanta; formerly District Engineer, Sacramento, California; succeeded General Albrecht as member of Commission and Vice Chairman; transferred to European Command in February 1963.

WILLIAM E. HIATT, Commissioner from the Department of Commerce; appointed December 16, 1958; native of Jay County, Indiana; served as hydraulic engineer with Federal Power Commission before joining U. S. Weather Bureau in 1940, has served since 1951 as Chief, Hydrologic Services Division, U. S. Weather Bureau, in Washington, D. C.; resides in Washington, D. C.

ROBERT C. PRICE, Commissioner from the Federal Power Commission; appointed December 16, 1958; native of Knoxville, Tennessee; formerly with Tennessee Valley Authority and private firms in hydroelectric project development throughout United States, Mexico, and Puerto Rico; has been associated with Federal Power Commission in Atlanta office for 15 years as Engineer-in-Charge of miscellaneous power and hydraulic studies before assuming present position as Regional Engineer; resides in Atlanta, Georgia.

HOWARD W. CHAPMAN, Commissioner from Department of Health, Education, and Welfare; appointed December 16, 1958; native of Smithburg, West Virginia; joined the Public Health

Service as a commissioned officer in 1943 and has served in a number of domestic and foreign assignments; formerly served as Regional Engineer, Atlanta; currently Associate Regional Health Director for Environmental Health, Atlanta, where he resides.

WALTER A. GRESH, Commissioner from the Department of the Interior; appointed December 16, 1958; native of Hummelstown, Pennsylvania; formerly with Pennsylvania Game Commission, Tennessee Valley Authority, West Virginia Conservation Commission; entered U. S. Biological Survey in 1939; from 1948 to 1954 served as Assistant Regional Director and since 1954 as Regional Director, Fish and Wildlife Service, Atlanta; resides in Smyrna, Georgia.

In addition to the Commission membership accounted for in the preceding biographical sketches, three changes in membership occurred during the life of the Commission, namely:

Major General Frank M. Albrecht served as the first Commissioner from the Department of the Army. He was appointed December 16, 1958, was subsequently elected Vice Chairman, and served to June 30, 1960, when he resigned from the Commission simultaneously with his retirement from the Army. A native of Denver, Colorado, General Albrecht was Division Engineer for the Corps of Engineers, South Atlantic Division, in Atlanta, during his service with the Commission.

Thomas A. Johnson, a native of Pensacola, Florida, was the initial appointee from the State of Florida. Mr. Johnson served on the Commission from his appointment on December 16, 1958, until his death on March 10, 1961. He had served in various State and local government offices in addition to his position as a business consultant.

John A. Short, who was appointed on December 16, 1958, as the Commissioner from the Department of Agriculture, resigned in June 1961. Mr. Short is a native of Green County, Illinois. He served with the Corps of Engineers, Department of the Interior, State of Missouri, and the President's Water Resources Policy Commission before joining the Department of Agriculture as representative on the Arkansas-White-Red Basins Interagency Committee. Mr. Short resides in Tulsa, Oklahoma.

SECTION IV – MEETINGS, HEARINGS, AND PRESENTATIONS

The initial meeting of the Commission was held on January 12, 1959; and since the organizational meeting, the Commission, with but few exceptions, has held at least one meeting of one or two days duration each month. Exceptions to this have been December 1960; February 1963; and April 1963.

In addition, Commission members participated in a series of four meetings designated as public hearings in November 1959 and in a series of 15 meetings designated as public presentations between March and August, 1962. These meetings are discussed in more detail in Part Four.

Most of the Commission meetings were held in Atlanta, Georgia, either in the Commission office in the New Walton Building or in the Corps of Engineers office in the Old Post Office Building. Meetings also were held in Anderson, South Carolina; Wampee, South Carolina; Jekyll Island, Georgia; Wakulla Spring, Florida; Pensacola, Florida; Clemson, South Carolina; Athens, Georgia; and Macon, Georgia.

Highlights of the Commission meetings are briefly summarized in Part Four, Section I, of this Appendix.

PART TWO – THE COMMISSION STAFF

Introduction

Staff organization and recruitment received considerable attention during early meetings of the Commission and continued to receive attention throughout the history of the Commission.

The services of Mr. George H. Mittendorf were made available on temporary detail from

the Department of the Army, Corps of Engineers, to serve as Acting Executive Director from February 8 to April 1, 1959, and intermittently as required from April 1 to May 2, 1959. Mr. George E. Tomlinson was selected as Executive Director and assumed his duties April 1, 1959.

SECTION I – ORGANIZATION

The chart, Organization Structure, Figure 2.1, shows the organization of the Commission and its operating staff. The concept for this basic

organization was adopted during the early meetings of the Commission and existed for the major portion of the study.

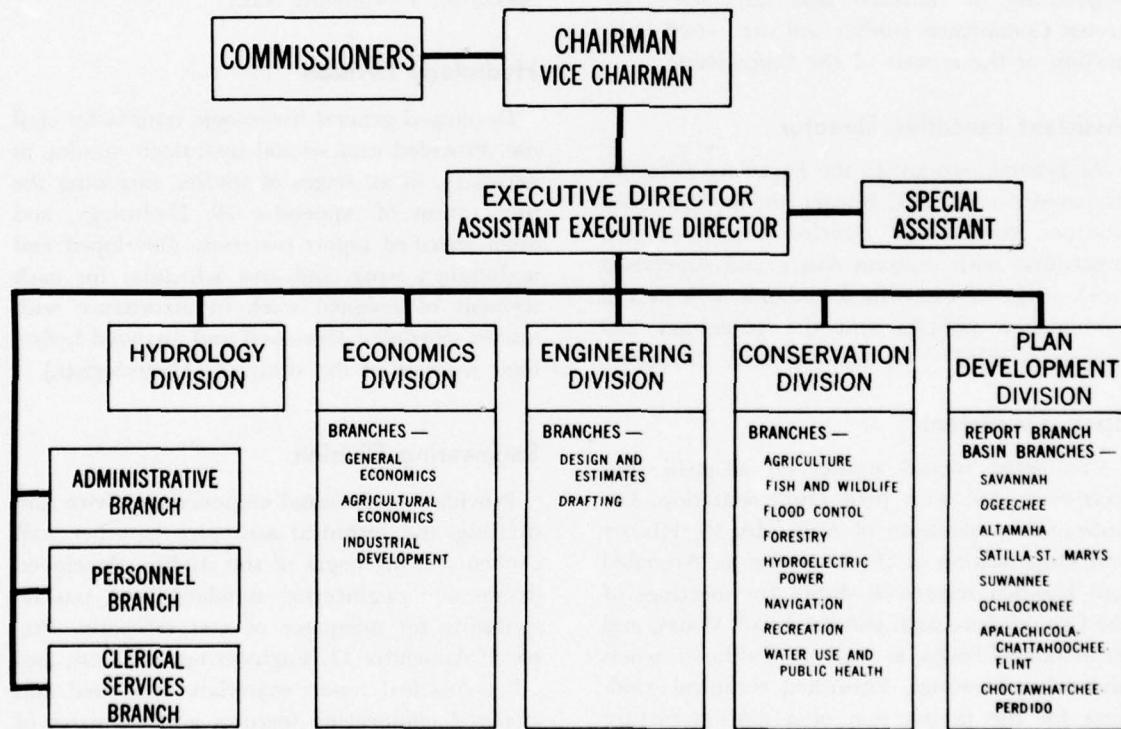


Figure 2.1 *Organization Structure.*

Following are statements of the assignments of the Executive Director, Assistant Executive

Director, Special Assistant, divisions, and branches shown on the organization chart, Fig-

ure 2.1. Positions listed in organizational segments indicate peak employment; generally about July 1962, and were not all filled concurrently.

Executive Director

The staff of the Commission was headed by the Executive Director, who directed, established, and administered, under the supervision of the Chairman and subject to policies established by the Commission, such regulations as were necessary for the execution of the work of the Commission except those administrative functions specifically restricted by law to the Chairman and Vice Chairman. Supervised the recruitment of the staff; the receiving, expending, and accounting of the Federal funds that were appropriated to the Commission; and the negotiating of contracts and agreements. Directed Commission studies and supervised preparation of the reports of the Commission.

Assistant Executive Director

As general assistant to the Executive Director, prepared consolidated budget and budget justifications, coordinated policies, objectives, and procedures with division chiefs, and supervised work of the divisions in accordance with overall Commission policies and the guidelines and criteria established by the Executive Director.

Special Assistant

Conducted special studies on assigned subjects associated with plan implementation. Coordinated preparation of Appendix 13, History and Organization of the Commission. Attended and handled secretarial duties for meetings of the Commission, staff, and the Land, Water, and Economics Groups as well as public hearings and other meetings. Furnished technical guidance for the preparation of a motion picture film, exhibits, charts, and graphs depicting the work and objectives of the Commission. Supervised the editing and distribution of press releases, other public relations material, periodic and interim progress reports, and staff notes. (1 Civil Engineer; 1 Administrative Assistant.)

Economics Division

Developed economic studies including appraisals of the assets and resources of the Southeast River Basins area and analyzed the trends, opportunities, and obstacles for future development. Developed an Economic Framework which recognized Commission approved criteria and assumptions. Determined the overall requirements for resource development and assisted in the single-purpose and comprehensive planning by providing uniform standards, techniques, and procedures for use in the evaluation of projects and programs, including measurement of benefits and costs, allocation of costs, cost sharing, and financing determinations. Prepared Appendix 9, Economics, and other specified report materials. (3 Economists, one of whom was on detail from Economic Research Service; 2 Agricultural Economists; 1 Industrial Development Specialist; 1 Economic Aid.)

Hydrology Division

Developed general hydrologic criteria for staff use. Provided professional hydrologic studies, as necessary, in all stages of studies, including the preparation of Appendix 10, Hydrology, and other specified report materials. Developed and maintained work and cost schedules for each segment of assigned work in accordance with master schedules. Reviewed and analyzed hydrologic features of the study. (2 Hydrologists.)

Engineering Division

Provided professional engineering advice and drafting and technical assistance to other staff elements in all stages of the studies. Developed design and engineering standards and was responsible for adequacy of cost estimates. Prepared Appendix 11, Engineering and Cost, and other specified report materials. Reviewed and analyzed engineering features and estimates of costs of all phases of the study for soundness and sufficiency. Assisted the Report Branch in developing standards and criteria for illustrative presentations. Made special studies and investigations. (1 General Engineer; 1 Civil Engineer; 5 Draftsmen; 1 Illustrator; 1 Engineering Aid.)

Conservation Division

Developed work plans for each of the functions enumerated in the authorizing legislation and insured the timely completion of the functional studies, properly coordinated with the staff and with cooperating agencies in accordance with prescribed standards and criteria. Provided professional advice in each of the functional fields to the other divisions. Through work agreements, or otherwise, made the required field studies and analyses; collected special functional data (except that specifically assigned to other divisions) in accordance with prescribed standards and criteria. Developed functional criteria, procedures, and methods, as necessary and required for the functional studies. Prepared Appendix 12, Planning, and other specified report materials. (1 General Engineer; 1 Conservationist (Fish and Wildlife); 1 Electrical Engineer; 1 Agriculturist; 1 Forester; 1 Conservationist; 1 Sanitary Engineer (on detail from Public Health Service); 1 General Clerk.)

Plan Development Division

Maintained close liaison with individuals and organizations in the Southeast River Basins area to ascertain needs and desires for resources development. Developed and prepared material for policies, procedures, and methods, as necessary and required, for the comprehensive studies and maintained continuity of their application. Developed report outline and report format with responsibility for writing, assembling, and processing of the Report. Reviewed functional plans and technical memoranda for facilitating their

usefulness in the preparation of the final Report. Formulated the comprehensive plan by coordination and integration of the several phases of studies in accordance with prescribed standards and criteria. (9 Civil Engineers; 1 Land Economist; 1 Agricultural Engineer; 1 Geographer; 1 Publications Editor; 1 Engineering Aid; 1 General Clerk.)

Administrative Branch

Developed and maintained fiscal control of the receiving, obligating, disbursing and accounting of funds. Provided administrative services, including office space, office equipment and supplies, travel and transportation, payroll, printing and reproduction, and messenger service. Assisted in preparation of budget data and justification. (1 Administrative Officer; 1 Administrative Assistant; 1 Clerk-Stenographer.)

Personnel Branch

Maintained recruiting facilities, personnel controls and records. Prepared necessary reports regarding personnel activities. Provided employee services and counseling. (1 Personnel Assistant.)

Clerical Services Branch

Provided stenographic and typing services to all elements of the organization, as needed. Developed and maintained correspondence and library files, work and leave records. (1 Secretary (Stenography); 1 Economic Aid (Typing), Part time; 8 Clerk-Stenographers; 1 Clerk-Typist.)

SECTION II – STAFF

DATES OF EMPLOYMENT AND PRINCIPAL ASSIGNMENTS

ADAMS, Harry W. – Assistant Executive Director, April 1959-December 1962.

ANDERSON, Jerome F. – Chief, Conservation Division, June 1959-March 1963.

ANDERSON, Ronald E. – Clerk-Stenographer, Administrative Branch, September 1961-August 1962.

ANGELL, Lester W. – Chief, Engineering Division and Chief, Navigation Branch, Conservation Division, April 1959 – *

APPEL, William H. – Chief, Recreation Branch, Conservation Division – September 1959-January 1963.

ARMSTRONG, Alva J. – Chief, Satilla-St. Marys Basins Branch, Plan Development Division, December 1959 – *

BANKE', Edward J. – Illustrator, Engineering Division, February 1962 – *

* Staff members whose termination dates are not shown completed their assignments with the Commission after April 30, 1963.

BECKMAN, Richard F. - Administrative Assistant and Secretary to the Commission, March 1959 - *

BELCHER, Owen D. - Economist, General Economics Branch, Economics Division, December 1959-March 1963.

BELVIN, Dorothy R. - Clerk-Stenographer, February 1962 - *

BIRD, Kenneth C. - Chief, Ochlockonee Basin Branch, Plan Development Division, July 1960 - *

BYRD, Jean P. - Clerk-Stenographer, Clerical Services Branch, January 1960 - *

CALHOUN, W. Kenneth - General Clerk, Plan Development Division, February-August 1962; Administrative Branch, August-October 1962.

CAMERON, John W. - Civil Engineer, Engineering Division, June-September 1961.

CHINN, Orville W. - Chief, Altamaha Basin Branch, Plan Development Division, May 1960-December 1962.

CONWAY, Clarence M. - Special Assistant, September 1959-July 1961; Chief, Plan Development Division, July 1961 - *

DODD, E. Ruth - Draftsman, Engineering Division, February 1962-January 1963.

GAY, Joseph T., Jr. - Chief, Apalachicola-Chattahoochee-Flint Basins Branch, Plan Development Division, and Beach Erosion and Hurricane Study Specialist, Conservation Division, June 1960-December 1962.

HALL, G. Robert - Civil Engineer, Plan Development Division, August 1960-April 1961; Conservation Division, April-October 1961; Chief, Choctawhatchee-Perdido Basins Branch, Plan Development Division, October 1961-April 1962 (Deceased).

HOWARD, Claire M. - Clerk-Typist, Administrative Branch, October 1959-July 1961.

HUGHES, Carol L. - Clerk-Stenographer, Clerical Services Branch, March-December 1959; April 1961 - *

HUGHES, Mark V., Jr. - Chief, Report Branch, Plan Development Division, January 1960 - *

HUGHES, Thomas L. - General Clerk, Administrative Branch, October 1962 - *

JONES, Wallace H. - Chief, Industrial Development Branch, Economics Division, March-December 1962.

KENNEDY, Kathryn W. - Clerk-Stenographer, Clerical Services Branch, August 1961-February 1963.

KING, Evangeline L. - Clerk-Stenographer, January-June 1959.

LARKIN, Richard L. - Publications Editor, Office of Special Assistant, October 1959-February 1961; Report Branch, Plan Development Division, February 1961-September 1962.

LARSON, Fred H. - Chief, Plan Development Division, September 1959-July 1961; Special Assistant, July 1961-February 1963.

LATON, Burle C. - Chief, Hydroelectric Power Branch, Conservation Division, March 1960-December 1962.

LEE, Sue B. - Clerk-Stenographer, Clerical Services Branch, July 1959-April 1963.

LELAND, Edward L. - Chief, General Economics Branch, Economics Division, March 1961 - *

LIGHTLE, Ruth L. - Clerk-Typist, Clerical Services Branch, January 1960-March 1961.

MCBRYAR, Margie K. - Clerk-Stenographer, Clerical Services Branch, August-November 1959.

MCDONALD, Earl J. - File Clerk (Typing) Clerical Services Branch, March-October 1961; Economic Aid (Typing), Clerical Services Branch and Economics Division, October 1961-April 1963.

MITCHELL, Roy W., Jr. - Engineering Aid, Special Studies, Hydrology Division, September 1959-June 1960.

MITTENDORF, George H., Jr. - Civil Engineer, Hydrology Division, June-August 1959; Engineering Division, September 1960-May 1961.

MOORE, Geneva S. - Draftsman, Engineering Division, July 1961-April 1963.

MORGAN, Horace P. - Chief, Agriculture Branch, Conservation Division, November 1959 - *

MORRIS, Mary E. - Clerk-Stenographer, Clerical Services Branch, November 1959-March 1963.

PARKER, Roger J. - Administrative Assistant, Administrative Branch, June 1959-January 1963; Administrative Officer, Administrative Branch, January 1963 - *

PHIPPEN, George R. - Geographer, Plan Development Division, September 1961-March 1963.

* Staff members whose termination dates are not shown completed their assignments with the Commission after April 30, 1963.

PORTWOOD, Mitzy H. - Clerk-Typist, Clerical Services Branch, October 1961 - *

REINKE, Richard E. - Chief, Ogeechee Basin Branch, Plan Development Division, April 1960-January 1963.

RIDLING, W. Richard - General Clerk, Conservation Division, July 1962-February 1963; Administrative Branch, February 1963 - *

ROGERS, Johnny C. - Draftsman, Engineering Division, March 1960-August 1962; Chief, Drafting Branch, Engineering Division, August 1962 - *

ROSSOLL, Karl H. - Engineering Aid, Special Studies, Hydrology Division, September 1959-April 1961; Plan Development Division, April 1961-February 1962.

RUSHIN, Emmett R., Jr. - Engineering Aid, Plan Development Division, June-December 1962.

RUSTIN, Beverly D. - Clerk-Stenographer, Clerical Services Branch, February 1959-August 1961.

RUTLEDGE, Dorothy B. - Clerk-Stenographer, Clerical Services Branch, March 1960-April 1961.

SANDERS, Charles M. - Agricultural Engineer, Plan Development Division, April 1961-March 1963.

SCKERL, Herbert A. - Engineering Aid, Conservation Division, June-July 1962; Engineering Division, July-September 1962.

SHERIFF, Peggy H. - Clerk-Stenographer, Clerical Services Branch, August 1959 - *

SHORE, Paul H. - Chief, Suwannee Basin Branch, Plan Development Division, February 1960 - *; Chief, Basin Branches, Plan Development Division, November 1961 - *

SIMMS, Alma J. - Clerk-Stenographer, Clerical Services Branch, January 1962-March 1963.

SMITH, Sara H. - Clerk-Stenographer, March 1959-February 1962.

SPECTOR, Albert H. - Chief, Forestry Branch, Conservation Division, September 1959-April 1963; Flood Control Specialist, Conservation Division, January 1962-April 1963.

SPENCER, Charles A. - Civil Engineer, En-

gineering Division, September 1961-February 1963.

STAPPAS, Jimmy T. - Electrical Engineer, Hydroelectric Power Branch, Conservation Division, June-July 1961.

TAYLOR, Calvin C. - Chief, Agricultural Economics Branch, Economics Division, October 1959-December 1962.

TIERNEY, Vada M. - Chief, Drafting Branch, Engineering Division, September 1959-August 1962.

Tomlinson, George E. - Executive Director, April 1959 - *

TOWNSEND, George E. - Civil Engineer, Plan Development Division, September 1961-April 1962; Chief, Choctawhatchee-Perdido Basins Branch, Plan Development Division, April 1962 - *

WALSH, Mary M. - Chief, Personnel Branch and Clerical Services Branch, February 1959 - *

WATKINS, Judith C. - Draftsman, Engineering Division, April 1961-January 1963.

WEBB, Dorothy C. - Secretary (Stenography), Clerical Services Branch, July 1959 - *

WEED, John O. - Chief, Administrative Branch, March 1959-January 1963 (Deceased).

WHELAN, Donald E. - Hydrologist, Hydrology Division, Chief, Flood Control Branch, Conservation Division, June 1959 - January 1962.

WILLIAMS, Ned L. - Chief, Economics Division, June 1959 - *

WILLMORE, Paul - Chief, Savannah Basin Branch, Plan Development Division, June 1961-February 1963.

WILSON, Walter T. - Chief, Hydrology Division, June 1959-December 1962.

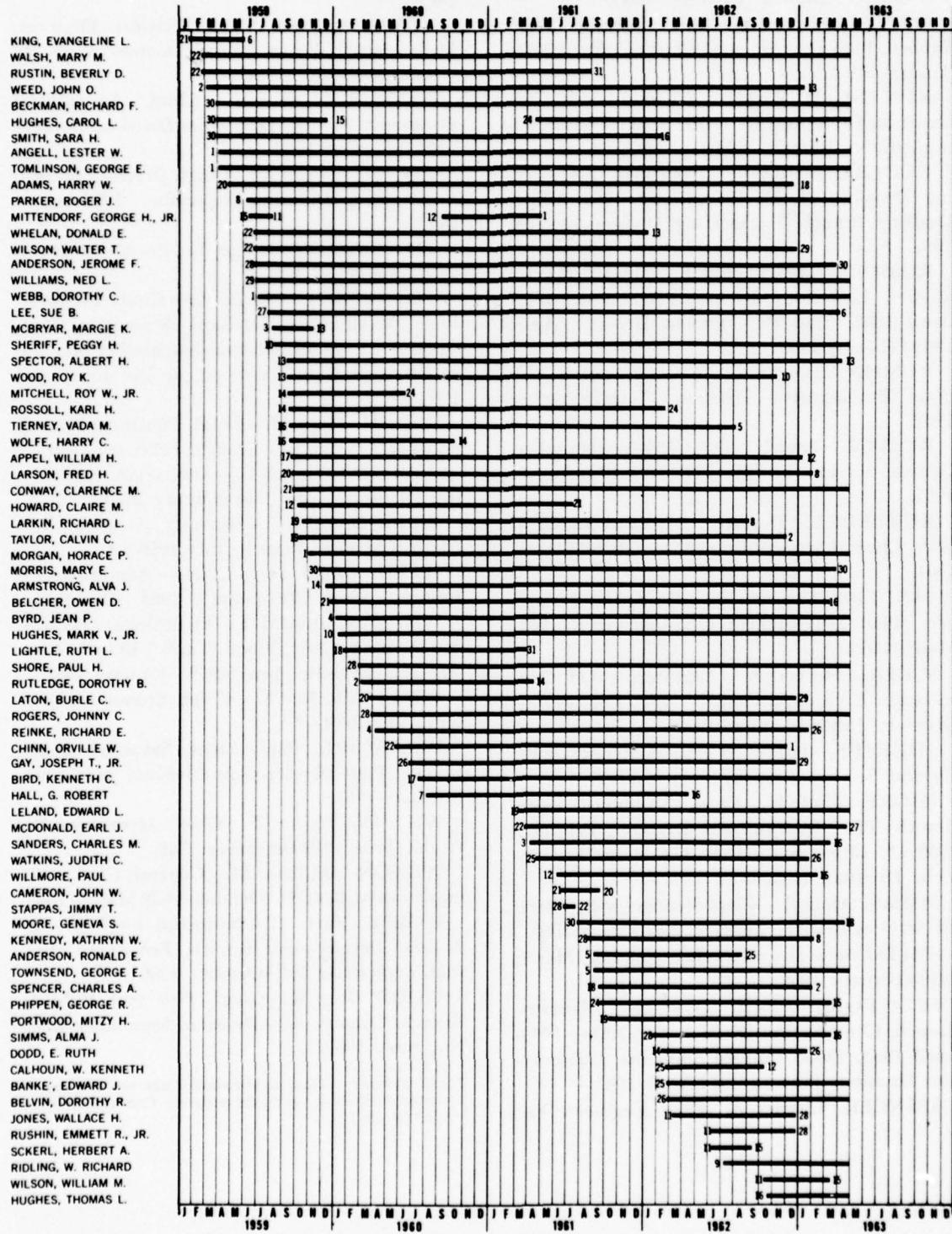
WILSON, William M. - General Clerk, Administrative Branch, October 1962-March 1963.

WOLFE, Harry C. - Industrial Engineer, Industrial Development Branch, Economics Division, September 1959-October 1960.

WOOD, Roy K. - Chief, Fish and Wildlife Branch, Conservation Division, September 1959-November 1962.

* Staff members whose termination dates are not shown completed their assignments with the Commission after April 30, 1963.

DURATION OF EMPLOYMENT



Note: The number at either end of each bar refers to the day of the month. Separations after April 30, 1963 not shown.

Figure 2.2

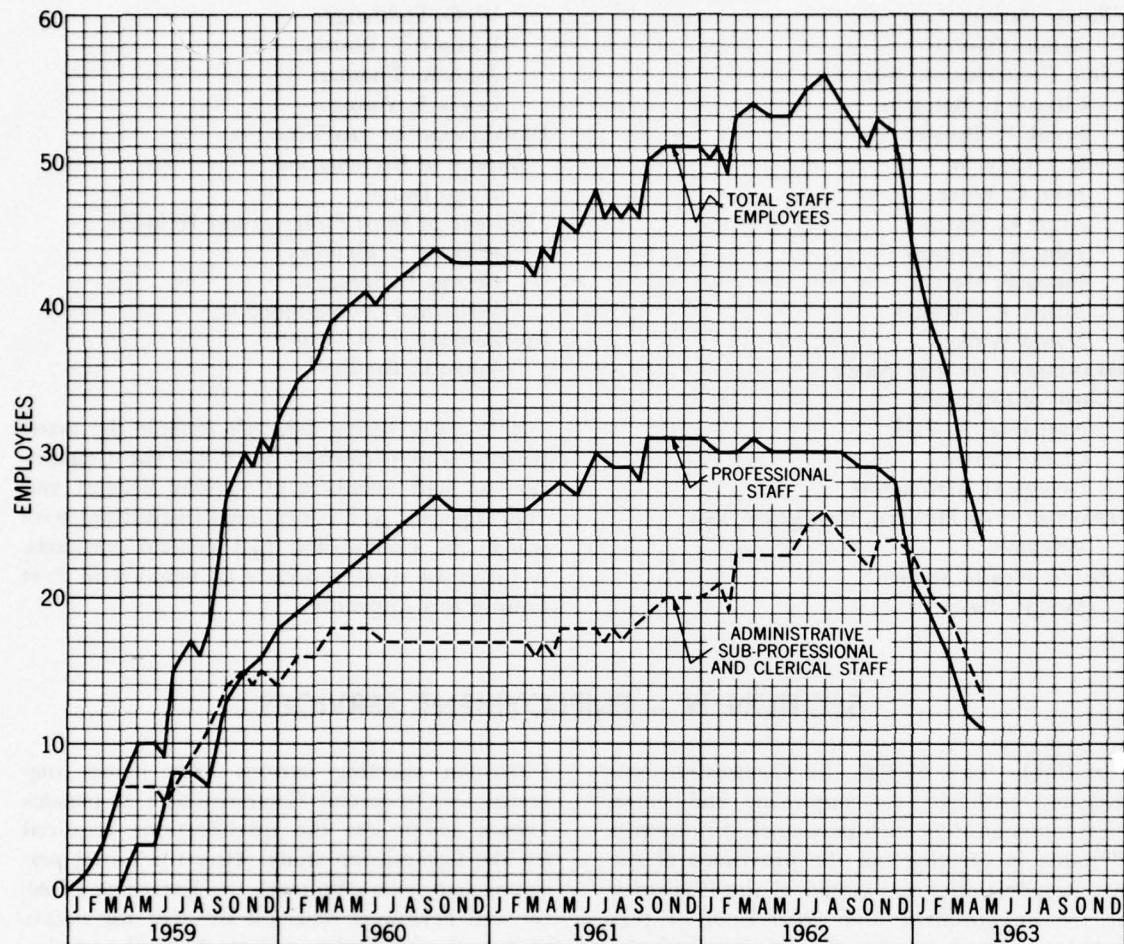


Figure 2.3 *Staff Employees by Months – January 1959-April 1963.*

SECTION III – SUPPLEMENTARY STAFF

CONSULTANTS AND OTHER INDIVIDUALS WHO ASSISTED THE COMMISSION STAFF

State, Local, and Non-Government

- J. Homer Blackstone – Consulting Economist, Auburn University
- Albert S. Fry – Consulting Engineer, Knoxville, Tennessee
- John L. Fulmer – Consulting Economist, Georgia Institute of Technology
- Milton Kafoglis – Consulting Economist, University of Florida
- Horace G. Loftin – Consulting Fish and Wildlife Specialist, Tallahassee, Florida
- Carter Page – Consulting Engineer, Alexandria, Virginia (Deceased June 1961)
- T. A. Pasto – Planning Consultant, Florida Development Commission

Albert W. Stubbs – Attorney, Columbus, Georgia

Ernst W. Swanson – Consulting Economist, North Carolina State College

Harry Wiersema – Consulting Engineer, Knoxville, Tennessee

Miriam T. Williams – Planning Consultant, Atlanta, Georgia

Federal Government

DEPARTMENT OF AGRICULTURE

Economic Research Service

- Joseph P. Biniek
- Robert W. Harrison
- Mark M. Regan
- Thomas G. Toon

Forest Service
Arlene Daniel
Soil Conservation Service
Charles L. Bates, Jr.
Frank R. Brower
E. J. Clay, Jr.
John C. Elder
Alton C. Harris
John A. Johnson
James F. Merritt
Buster P. Thomas
Irving Walker
DEPARTMENT OF THE ARMY
Corps of Engineers
Nathaniel A. Back
Clarke Carter
George H. Mittendorf
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Jack R. Davis

W. G. Eichberger
Richard F. Poston
John R. Thoman
Lewis A. Young
DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
Hugo Duhn
Bureau of Sport Fisheries and Wildlife
Rolland B. Handley
George D. Scruggs
William F. Youngblood
SMITHSONIAN INSTITUTION
James C. Bradley

The above listing does not include the many persons who performed work for the Commission as staff members of various Federal and State agencies, and educational institutions with which the Commission had general contracts. A listing of these contracts is included in Part Four of this Appendix.

SECTION IV – EMPLOYMENT SERVICES

In Public Law 85-850, the Commission was delegated authority for employing and fixing the compensation of such personnel as it deemed advisable in carrying out the provisions of the Act. Responsibility was vested in the Chairman for the appointment and supervision of personnel employed by the Commission and the distribution of business among such personnel.

Although the Chairman and the Commission were authorized to act on all matters pertaining to personnel without regard to the provisions of the Civil Service Laws and the Classification Act of 1949, as amended, the decision was made to adopt many of the fringe benefits and other provisions established for all Federal employees and certain of the programs which the Civil Service Commission has responsibility for administering or prescribing procedures. Among these benefits and programs were Federal Employees Group Health Insurance, Federal Employees Group Life Insurance, and the annual and sick leave plan.

Recruitment

The initial recruitment of the staff of the Commission was accomplished primarily by the

Chairman selecting persons from names suggested by the several Commissioners as persons known to possess the qualifications required for the Commission study. After the initial personnel had been employed, the Executive Director and Personnel Assistant solicited the names of prospective employees from Federal agencies, the Civil Service Commission, and Commission staff members, and reviewed and analyzed the resulting applications to obtain the best qualified person available for each position established. It was decided early not to recruit professional employees from local State agencies and educational institutions but rather to utilize persons in these organizations by means of reimbursable contracts with the agency or university. This was done so as not to encourage emigration of professionally competent persons from the area as the Commission completed its work. Many of the professional staff members were former Civil Service career employees whose assignments with the Commission constituted a continuation of their service with the Federal Government.

Some of the nonprofessional staff members were recruited by contacts with the Georgia

State Employment Service, local business colleges, and the Atlanta Region of the Civil Service Commission. Others joined the staff as a result of recommendations by other staff members.

Re-Employment Rights

The Secretaries of the various Departments of the Federal Government cooperated with the Chairman by furnishing invaluable assistance in staffing the Commission. They not only made the necessary arrangements for the release of highly specialized personnel to accept assignments with the Commission but also in many instances granted these persons re-employment rights in their former agencies.

Retirement — Civil Service and Social Security

Many of the professional staff members were

career employees in the Federal service and the Chairman made provision for them to continue their membership in the Civil Service Retirement System and to add to their benefits. Staff members without previous Federal Government service had Social Security coverage. This arrangement provided continuous coverage under a retirement system for all staff members.

Salary and Grade Structure

A grade structure and salary rates were established paralleling those used in the General Schedule for employees under the Classification Act. Provision was made for promotion from grade to grade occasioned by the assignment of additional duties and responsibilities and for advancement within grade based on an adaptation of the system for periodic step increases applicable to personnel whose positions are under the Classification Act.

PART THREE - STUDY HISTORY AND ORGANIZATION

SECTION I - GENERAL CONCEPT OF STUDIES

Organization of the Commission studies was shaped by the authorizing legislation and by instructions from the Executive Office of the President. The Commission augmented the directives in the authorizing law and instructions from the Executive Office of the President with the adoption of objectives and policies to guide the studies.

Objectives and Goals

The purpose, role, goals, and policy objectives adopted by the Commission to be used in the study are summarized briefly in subsequent paragraphs.

Purpose and Scope

The primary purpose will be to prepare a comprehensive plan for the conservation, utilization, and development of the land and water resources of the designated Southeast area. The scope of the study will include all general benefits, present and future, which are realizable from land and water resources. More specifically, data will be assimilated and coordinated for: Flood control, navigation, irrigation, hydroelectric power, fish and wildlife, water quality control, salinity, public health, water supply, reclamation, drainage, industrial development, recreation, sediment, pollution abatement, soil conservation, and forest conservation.

Goals and Policy Objectives

(1) Formulate a plan for the eventual development and sustained use of the land and water resources in the area of the Commission study. Priority will be given projects expected to make the most effective use of available resources and the maximum contribution toward improving the general welfare of the area. This will necessitate a comprehensive program for all of the land and water resources in the area as a whole, as well as for each of the basins.

(2) Recognize that a balanced and orderly schedule for achieving eventual optimum development must have sufficient flexibility to adjust to changing national, regional, and area conditions.

(3) Recommend an equitable sharing of financial responsibility in accordance with benefits received and compatible with sound use of resources.

(4) Acquire, analyze, and disseminate planning information and explore and weigh alternatives. All interests concerned will have an opportunity to participate in the planning of the program.

(5) Protect existing and authorized projects and projects

under construction whether public or private.

(6) Establish the necessary economic incentives, directional measures, regulations, and organizational arrangement to promote most effectively the attainment of these program objectives.

A more formal statement of "The Objective" of the U. S. Study Commission, Southeast River Basins, was approved by the Commission, March 1960. It provided that the objective of the U. S. Study Commission, Southeast River Basins, is to ascertain the maximum contribution of the resources of the study area to the future development, strength, and general welfare of the region, as well as the Nation. Specifically, this involves the making of an integrated and cooperative investigation, study, and survey, and the formulation of a comprehensive and co-ordinated plan as a means of assuring optimum, sustained use of the land and water resources of the region in the light of the overall requirements.

Significant Study Factors

The satisfaction of human needs and desires was the basic factor underlying all studies. Throughout the Act there is reference to both land and water resources, neither of which is stated or inferred to be superior one to the other. Thus, it was the interpretation by the Commission that none of the purposes specified in the Act is considered supplemental or subordinate to the others. The organization and selection of the studies were designed to effectuate equality in the treatment of land and water and the purposes specified in the Act.

The Southeast River Basins Report covers private sectors of the economy as well as governmental activities in land and water resource development at both Federal and non-Federal governmental levels. Recognizing this broad aspect of the plan, private as well as government, it was deemed desirable to obtain as much State and local participation as possible and to utilize sources of information and co-operation from private business and State and local organizations.

The U. S. Study Commission staff included persons experienced in land and water resource planning both native or long-time residents of the southeastern area and from other areas. Personnel from other areas contributed a variety

of resource planning ideas and native-born or long-time residents on the staff provided local viewpoints concerning land and water resources. The staff was deliberately kept small with much of the detailed work accomplished by contracts and agreements.

Another factor in the organizational concept of the study was that the authorizing Act provided that the U. S. Study Commission was responsible for planning only with no responsibility for installation or operation of elements of the plan. In short, the Commission was specifically designated as a temporary agency that would cease to exist 3 months after the submission of its Report to the President. The temporary nature of the Commission was a significant factor in working with established agencies who were thus assured by this provision of the law that the Commission would have every reason to be objective and would not be an organization trying to perpetuate its life by planning work for itself to do in the future.

Adopted Planning Procedures

An overall planning procedure that included four fundamental steps was adopted: (1) An inventory of resources, (2) an analysis and projection of the needs as of years 1975 and 2000, (3) preparation of single-purpose alternative plans for each function, and (4) formulation of a comprehensive plan. Although these steps are enumerated separately, in practice, work

on all of the steps proceeded more or less concurrently in most instances.

The study area consists of a series of river basins specifically named in the authorizing Act plus all the intervening areas not specifically named in the Act. To facilitate work, the study area was divided into eight basins; each was named by the dominant river system or a combination of rivers.

The selection of basins and a study sequence for them enabled cooperators and staff members to have a coordinated time basis for their efforts. Agencies were encouraged to work on all or several basins concurrently as long as established completion dates could be met which reflected the basin sequence. In some instances, the cooperators had difficulty in submitting complete reports on the agreed dates, especially for the basins scheduled for early completion.

The eight basins were studied and the reports drafted in the following chronological order:

Ogeechee
Satilla-St. Marys
Suwannee
Ochlockonee
Choctawhatchee-Perdido
Savannah
Apalachicola-Chattahoochee-Flint
Altamaha

The Ogeechee basin was used for the pilot application of policies, procedures, report presentation, and other matters. Figure 1.1, Appendix 12, shows basin boundaries, names, and numbers.

SECTION II – BASIC STUDIES

Selection of a series of basic studies was a significant action in the history of the overall study. By design, the Commission effort was to culminate in an integrated, comprehensive plan. It was reasoned that data for different basins within the study area and data in the several specified functional fields must use common terms which, in turn, would contribute to making all parts of a plan compatible. The basic studies provided a general inventory of information concerning the area resources, problems, potentialities, and projections of the broad parameters of the future economy of the area.

Soon after the Commission was activated, it was decided to use 1960 generally as the base

year and the years 1975 and 2000 as key dates in the future. Also, it was agreed that projected needs would be related to the needs of people for products and services contrasted to the other types of needs. For example, some other plans are premised on the needs of the forest for improved growing conditions contrasted to needs of the people for forest products; or the needs of wildlife for certain habitat contrasted to the needs of people for hunting opportunity. Thus, it is easy to reason that population is a factor basic to all phases of the study. Other basic subjects similarly were identified as having application in two or more functions and in more than one basin of the study area.

Following are some basic studies sponsored by the Commission: Population projections and analyses of population characteristics; trends and projections of per capita and total personal income, employment and labor force; analyses of growth factors for selected industries; survey of industry plant location intentions; growth industry analysis; mineral resources and projected production; trends and projections of agricultural land use and production; farm pond inventory; hydrological characteristics; water quality; ground water; influence of water resources on the economy; 1960 water use; flood forecasting; leisure time; inventory of damsites; and transportation.

The details of the series of basic studies are covered in conjunction with the appendix element where they appeared to have the most significance. This does not mean that they were not used in other parts of the study. The population projections and the related income and employment studies were important considerations in all basins and in all functions but are described primarily in Appendix 9, Economics. Leisure-time studies of special significance to recreation, and closely related to population and employment are covered in Appendixes 9 and 12.

The land-grant colleges in the States of the Commission study area assembled, under reimbursable cost arrangements, agricultural information from their files and prepared production and land-use projections for 1975 and 2000, based upon their experience and knowledge. Similarly, Georgia Institute of Technology prepared data on nonagricultural aspects of the Southeast River Basins area.

An Economic Framework for the Southeast River Basins area was formalized in July 1960, utilizing data compiled earlier. It was refined and extended to include data for each of the eight river basins and was a basic and significant guide for the planning effort. Consideration was given to the results of a great many basic studies in making projections of population, employment, income, and agricultural land use and production. Uniform expression and usage of the base framework elements of population, income, and employment permitted comparisons of land and water resources data, especially data from functional studies, to be analyzed and tested for reasonableness. The Economic Framework is presented in Appendix 9, Economics.

SECTION III – FUNCTIONAL STUDIES

The main objective of the functional studies was to assemble for each function or purpose to be served by the plan data on (1) the inventory of resources and existing development; (2) the needs, present and projected; and (3) the single-purpose alternative ways of meeting the needs. Compilation of information by functions or purposes was a means of organizing the mass of data to be considered in formulating the comprehensive plan. *Function* and *purpose* are used as synonymous terms in this Appendix.

Inventory information included both the physical resources and existing development. Unless stated otherwise, the term "existing" is used to describe developments installed, under development, or authorized as of 1960.

Needs covered in each function or purpose included both those existing and satisfied as of 1960 plus those existing and not satisfied as of 1960. Projected needs cover those expected by

the year 2000 with 1975 needs as an interim benchmark.

Single-purpose projects and programs and alternatives are ways of meeting needs with the available resources without considering the competitive, tempering influences of development plans for other purposes. Alternatives are useful in developing the single comprehensive plan.

Work plans for each function were prepared through the leadership of staff specialists. Work performance was accomplished mainly by contract with non-Federal entities and by formal agreement with Federal agencies. Major staff functions were supervising the work, interpreting the study results, and applying the information to the plans as they were formulated by the Commission. Supervisory guidance of the agreements and contracts by the staff was a significant factor underlying the studies. Functional studies are described in more detail in Appendix 12.

SECTION IV - COMPREHENSIVE STUDIES

The objectives of the comprehensive planning by the Commission were to provide for development, use, and conservation of the land and water resources consistent with the present unsatisfied needs and future requirements as developed from the Commission criteria, assumptions, and projections.

Major considerations were: (1) To meet all requirements with reasonably compatible measures and (2) to meet them with economic efficiency. For many of the requirements this could be accomplished best by new multiple-purpose land and water projects to supplement both existing developments and continuing programs.

The controlling assumptions are stated in the Report of the Commission and amplified in Appendix 9, Economics; in Appendix 10, Hydrology; in Appendix 11, Engineering and Cost; and in Appendix 12, Planning.

Data for developing the comprehensive plan were obtained from published and unpublished sources and special investigations. Views of local interests on the course the study should take were obtained at a series of public hearings. Data developed in functional studies were used in the preparation of comprehensive plans. Where it was necessary to obtain additional data to augment the functional studies or to explore new possibilities, study plans were developed as a basis for continuing agency studies. These were initiated in March 1961.

The resource planning of the Commission recognized the economic consequences of land and water resource development and the need to anticipate the future requirements of land and water essential to social and economic growth and welfare. The economic aspects of the planning task were emphasized, particularly as they relate to the scale, sequence, and timing of development plans. Considerable attention was given to the economic impact of land and water development on community and area growth. Economic considerations were tempered and, as they are throughout our society, sometimes overruled by social, legal, and political preferences.

The Commission plan was developed on the basis of a free enterprise economy for the area and the Nation in which the government undertakes those tasks which are beyond individual or voluntary group capacity or which, for special physical, economic, social, or other reasons, require Federal or State Government assistance. In all of the Commission planning, the Southeast River Basins area is considered an integral part of the national economy, with recognition being given to local and regional viewpoints where these are appropriate to the plan development.

Comprehensive planning activities are covered in more detail in other appendix volumes especially basin appendixes, numbered 1 through 8, and Appendix 12, Planning.

PART FOUR - COORDINATION

SECTION I - THE COMMISSION AS A COORDINATOR

Introduction

There is only a brief legislative record relating to S.4021. Therefore, interpretations of Public Law 85-850 have been based largely on consultations of Commission representatives with members of the Congress, personnel in the Bureau of the Budget, and the Public Works Assistant to the President.

The directives in Public Law 85-850, including those dealing with the makeup of the Commission, emphasized the Commission role as a coordinator, a role which became dominant as the study progressed. The Commission members representing Federal Departments brought to the conference table the views of the constituent agencies; the State members, through their contact with State officials, were able to present State and local viewpoints. The monthly *Commission meeting* was the forum in which the various viewpoints were exchanged and policy decisions reached.

The collective experience of the individual Commissioners was a vital force in formulating policy. At the meetings, the Commissioners contributed to technical aspects of the study although generally technical assistance was effected by each Commissioner working with the Executive Director or with members of the steering groups and functional and basic committees. Technical contact with cooperators was a staff responsibility within the guidelines developed by the Commission. Advice and consultation was also furnished the staff by the steering groups and the functional and basic committees. Many of the detailed technical comments pertaining to reports were submitted by letter by committee and group members.

Development of Policy and Procedure

Policy and procedure were developed step by step in anticipation of staff and Commission needs. Generally, a paper on an item of policy or procedure was originated by a staff element as the work progressed; but in other instances,

suggestions for papers originated with the Commission. After the original need was indicated, preparation of a staff paper was often preceded by the presentation of a discussion-type paper which developed the various aspects of the subject. On occasion, this discussion was continued for several meetings.

The staff paper, upon completion, was presented to the Commission by the staff member responsible for its preparation. The paper was then considered by the Commission for adoption if policy matters were involved. If revisions were requested, the paper was generally presented again in the revised form.

In some cases, the Commission discussions were based on informal presentation of the subject matter in lieu of a formal staff paper.

Scope of Commission Discussions

The Commission reviewed and acted on numerous staff papers and gave consideration to a wide range of both general and technical subjects. Highlights of the Commission meetings, including selected agreements, actions, and policy decisions follow. The listing is not complete either as to subject matter covered or in the sense of being fully definitive as to actions taken but is intended to provide a general insight into the nature and scope of Commission discussions and decisions.

Initial Meeting and Early Policy Decision

At the organization meeting held on January 12, 1959, Mr. Floyd D. Peterson, representing the President's Special Assistant for Public Works Planning, briefed the Commissioners on their duties and outlined, in general terms, the nature of the study to be undertaken and the laws under which the Commission would operate. In discussing the Commission study area, the question arose concerning inclusion of the Suwannee basin as a definite part of the intervening area outlined in Public Law 85-850. The Commission agreed to include the Suwannee basin, if

this were agreeable to members of the Florida Congressional Delegation, as being the area the Congress had in mind when the authorizing legislation was enacted. At a subsequent meeting, Chairman Woodruff reported no objection was raised by the members of the Florida Congressional Delegation he contacted and that the Suwannee basin would be included as a part of the Commission study area.

Atlanta was approved as the location of the Commission's main office with further provision for an office for the Chairman in Columbus, Georgia. It was also agreed at the February 2, 1959, meeting to permit alternate observers to attend meetings in the absence of a Commissioner but such alternates would not have a vote. Agreement was also reached to use "U. S. Study Commission, Southeast River Basins" as the official designation of the Commission subject to approval by the Bureau of the Budget and the Congress. This shorter name was later cleared with the Bureau of the Budget and the Congress during the course of Appropriations Hearings.

At the first meeting, the Commissioners also discussed the time limitation of the study. Congress had not established a date for report completion in Public Law 85-850 so late 1961 was established by the Commission as a target date, pending the analysis of existing data and the capabilities of cooperating agencies. In February 1960 a revised date of early 1963 was established for submission of the Report to the States and Federal Departments for review.

The Objective

In order to establish a clear-cut objective or goal for Commission studies, the Commission approved a formal statement entitled, "The Objective," in March 1960, as discussed in Part Three, Section I. This "Objective" was a more formal statement of "The Goals and Policy Objectives" adopted by the Commission early in 1959 and widely distributed in a brochure which was completed in August 1959.

Report Objectives

A set of guidelines and principles, consistent with the overall Commission objective, approved March 1960, were outlined by the Commission and approved for staff use in April 1960. In-

cluded were decisions concerning phasing of studies, equal treatment of all functions, use of both tangible and intangible benefits in project formulation, and inclusion of cost-sharing considerations in the study. The guidelines also provided that the recommended plan should recognize and protect the rights and interests of the States in land and water development proposals and that periodic review of the comprehensive plan at appropriate intervals be recommended.

Projection Dates for Study

At the March 30, 1959, meeting, the Commission held its first discussion of projection dates to be used in the studies for long-range planning and agreed to an early action phase date of 1975. The years 2000, 2010, and 2020 were discussed as projection dates for the long-range future action phase. The Commission agreed at the April 16, 1959, meeting to use the year 2000 as a cut-off date for the long-range planning.

Steering Groups

The Commission created steering groups and basic and functional committees as technical advisors and specialists in the various functions and for the special subjects considered in the Commission study. Membership included representatives from the various State and Federal agencies most closely associated with the basic or functional activity being handled by the respective groups, basic committees, and functional committees. The steering groups began meeting on a regular basis in September 1959. Starting with the May 1961 meeting, the Land, Water, and Economics Groups met in joint session and reviewed the basin plans throughout the various stages of refinement.

Report and Appendix Outlines

One of the early Commission actions was the consideration of a report outline for the purpose of setting forth in simple and concise terms the purpose of the study and report. An Abridged Outline of Main Report and Abridged Outline for Typical Basin Appendix were approved at the April 1960 meeting. Related to the Report Outline were Commission discussions and action on the Form of the Final Report, which outlined the size, format, and content; the Report

of the Commission and Appended Material, which established the number and context of the Report and Appendixes; and Timing of the Report, which included such features as the schedule for staff review and the review of the proposed Report and Appendixes by the Governors and Department heads, as required by legislation. Closely allied was Report Objectives, which provided basic guidance to the staff and was translated into work items, such as the basic studies and functional studies, started in 1959; and terminal studies, started in March 1961.

General Policy on Economic Criteria

The Commission adopted a set of principles to be followed in the economic analyses which were directed toward the formulation of a comprehensive and fully unified plan for the optimum utilization of the land and water resources in the Southeast River Basins. The objective of the economic analyses was to provide a guide for the most effective utilization of the economic resources in producing goods and services to satisfy human wants.

Approval of Assumptions and Working Procedures, which outlined general assumptions on population, the general economic environment, and the procedures to be followed in the various price and cost projections was given at the March and May 1960 meetings.

Bureau of the Budget Circular A-47 and Senate Resolutions

Bureau of the Budget Circular A-47 and Senate Resolution 148, 85th Congress, documents relating to standards and procedures to be used in formulating and evaluating proposed water and land resources project reports and estimates, were discussed by the Commission, which agreed at the March 1960 meeting to recognize, to the extent practicable, both of these documents. Later in the study, Senate Document 97, 87th Congress, was received and considered by the Commission.

Period of Analysis

In considering the period of analysis to be used in Commission studies, attention was given to existing practices of various resource development agencies and to the direction provided by

Bureau of the Budget Circular A-47 and Senate Resolution 148. The policy approved provided that the period of analysis to be used in the studies would be the economic life of each project or program, as established on the basis of an individual analysis; any economic life greater than 50 years would be carefully scrutinized and fully supported and in no case would an economic life in excess of 100 years be used. Generally, 50 years was the upper limit.

Interest Rates

The Commission adopted an interest rate of 2½ percent provided by the Bureau of the Budget to Federal agencies for use in resources studies. The 2½ percent rate of interest was used for the Federal resource projects to reflect a relatively risk-free and inflation-deflation-free rate. The Commission further proposed and adopted a 1½ percent increase in rate of interest (4⅓ percent) for use in non-Federal project evaluation. This rate was later increased to 4¼ percent in order to permit use of standard rate tables and to include a modest allowance for additional risk.

Treatment of Taxes

The Commission studies include taxes as an item of cost for all projects which have power features. Consideration was given to Senate Document 97, 87th Congress, which provides for exclusion of taxes as an item of expense in project formulation studies. However, the decision to include taxes was made in order that the studies reflect realistic cost estimates for private power developments and so that Federal developments would be evaluated on a comparable basis.

Measurement Aspects of Benefits

Methods and procedures were developed to implement the Commission policy for benefit evaluation. Benefits were considered from both a national and regional viewpoint. The benefit procedures established were oriented toward a comparability of benefit measurements among functions. Consideration was given to both tangible and intangible benefits and primary and secondary benefits were considered for each of these major groupings. General approval of the

measurement aspects of benefits was given by the Commission at the July 1960 meeting.

Cost Allocation Procedures

The Separable Cost Remaining Benefits Method was approved by the Commission at the June 1960 meeting for use as the principal method of allocating costs. The Alternative Justifiable Expenditure Method and the Use of Facilities Method were also approved as satisfactory alternatives under appropriate conditions.

Cost Sharing

Consideration was given to the basic concepts of cost sharing, present Federal laws and policies for cost sharing, and proposals made for cost-sharing recommendations to be used in Commission studies. Each of the basin plans was then reviewed on a project-by-project basis and specific cost-sharing rates developed, based on the project purposes, locational factors, and other considerations.

Financing

It was recognized that success of the Commission plan would depend to a great degree upon the development of an effective program for financing the natural resource programs and projects required for the anticipated economic growth of the Southeast and the Nation. The Commission gave consideration to this problem and the financial feasibility of the recommended plan of development for the Southeast River Basins area. Studies made point up the magnitude of the financing required and indicate several possible ways of financing both public and private resource development. From these observations, the Commission adopted a general policy on financing which has been closely adhered to in the Report.

Designation of Federal and Non-Federal Responsibilities

In July 1962, the Commission established a policy concerning the designation of Federal Department responsibility for construction and operation of projects and programs in the plan. The criteria provided that, for single-purpose projects and programs, the Federal Department usually associated with the program would be designated; and for multiple-purpose projects

and programs, the Federal responsibility would be placed with the Department usually associated with the purpose having the largest share of the allocated costs. Where neither of the two preceding criteria resulted in a clear-cut designation, selection would be made on a case-by-case basis. The forestated policy was subsequently broadened to include additional criteria for designation of Federal and non-Federal jurisdiction, consideration of incidence of benefits and landownership, and different responsibilities for operation and maintenance from those involved in planning and construction.

Resources Advisory Board

The Commission members recognized the importance of continuing coordination between Federal and State Departments and the need for periodic updating of the studies in order to further coordinate new and/or revised proposals for both private and Federal resource developments. Accordingly, specific recommendations were included in the plan for establishment of a Resources Advisory Board to carry on the coordination and to update the studies and keep the plan current. The proposed board would consist of one member from each of the four principal States; one member from each of the Federal Departments on the present Study Commission, and a Chairman from the area at large. The expense of the proposed Resources Advisory Board would be borne by the four States on a pro rata basis, recognizing population, size of the State area included, and per capita income. The Commission also proposed that, pending the establishment of the Resources Advisory Board, an interim organization be established to facilitate and coordinate the implementation of the plan.

General Commission Actions

In addition to actions on the specific subjects shown in this Section, the Commission in its monthly meetings performed numerous other tasks, many of them on a month-to-month continuing basis. For instance, in the early months of the Commission, a part of each meeting was devoted to staff reports on the basic and functional studies, function by function, and on the contracts and agreements with the various Federal and State agencies, colleges and univer-

sities, and individuals. Also, each month the Commission reviewed the status of funds, status of staff personnel, and progress report statements. The Commission kept abreast of the activities of the States and Federal Departments of their fellow Commissioners and reviewed such reports as the Crossley Survey on Hunting and Fishing, Senate Select Committee Report on National Water Resources, and Presidential messages on Natural Resources and Transportation. The Commission also early established a program to secure and maintain a program of liaison with the general public, an item discussed in more detail in Section II.

The step-by-step development of the Commiss-

sion plan and drafts of the Report and the 13 basin and technical appendixes utilized significant portions of the later Commission meetings. The Report and each of the Appendixes received reviews by the staff, the Economics, Land, and Water Steering Groups, and the Commission first in "rough" form; next in "preliminary" form; then as the "proposed" Report, and finally as the formal Report of the Commission.

By December 1962, a draft of the proposed Report and Appendixes was completed. The proposed Report was transmitted for official review to the Governors and Federal Department heads on February 15, 1963.

SECTION II - LIAISON AND PUBLIC RELATIONS

It was considered important to keep the public currently informed of Commission activities.

From the beginning, frequent use was made of news releases for newspapers, radio, and television. The news releases pertained generally to Commission appointments, staffing, transfers, availability of funds, public hearings, public presentations, and to official visits and talks by Commissioners and staff members.

A quarterly Activities Report was written and mailed to approximately 3,000 individuals, agencies, and business concerns; simultaneously, a Quarterly Status Report was submitted to the President and to members of the Commission. In addition, all Commissioners and staff members received a copy of Staff Notes, an internal office information sheet issued twice a month.

A documentary film, "Plan for Tomorrow," was prepared for the Commission by the University of Georgia, Center for Continuing Education. It was completed in time for the public presentation at Geneva, Alabama, and was used at subsequent presentations. This 25-minute, 16 mm. color film, narrated by Douglas Edwards, shows and tells how problems of water, land, and other natural resources are being studied today to anticipate the needs of tomorrow. Nine prints were obtained and distribution was arranged through a commercial booking firm and from the Atlanta office of the Commission, and the University of Georgia, Center for Continuing Education. Continuing availability of this film is provided through copies deposited with the film libraries of Georgia Institute of Tech-

nology, University of Georgia, University of North Carolina, University of South Carolina, Clemson College, Auburn University, University of Alabama, University of Florida, and Florida State University.

During November 1959, the Commission held a series of public hearings as follows:

1. Tallahassee, Florida	Nov. 16, 1959
2. Dothan, Alabama	Nov. 17, 1959
3. Macon, Georgia	Nov. 18, 1959
4. Anderson, South Carolina	Nov. 19, 1959

The public hearings were held for a twofold purpose. First, the hearings were held to explain the organization of the Commission, its functions and its objectives; and second, to obtain a first-hand knowledge of the land and water resources problems in the Southeast River Basins area and to obtain the views and desires of all interested persons concerning land and water resources developments.

The hearings were attended by approximately 500 persons. Many papers and talks were presented by the persons attending. A transcript of each of the hearings was prepared containing the invitation list, names of attendees, names of active participants, remarks by the Commissioners and papers and transcripts of talks. The material obtained during and following the public hearings was studied with care during the planning process and in establishing further contacts with interested groups throughout the study area.

When the coordinated comprehensive plan for the Southeast River Basins had been de-

veloped to the point where the projects and programs under consideration could be presented to the public, a series of public presentations were held, as follows:

1. Statesboro, Georgia	March 20, 1962
2. Waycross, Georgia	March 23, 1962
3. Tallahassee, Florida	May 15, 1962
4. White Springs, Florida	May 17, 1962
5. Valdosta, Georgia	May 18, 1962
6. Geneva, Alabama	June 19, 1962
7. Pensacola, Florida	June 20, 1962
8. Savannah, Georgia	July 16, 1962
9. Clemson, South Carolina	July 17, 1962
10. Atlanta, Georgia	August 13, 1962
11. Columbus, Georgia	August 14, 1962
12. Albany, Georgia	August 14, 1962
13. Baxley, Georgia	August 15, 1962
14. Macon, Georgia	August 16, 1962
15. Athens, Georgia	August 17, 1962

The purpose of the series of public presentations, which were co-sponsored by the Governors of the States directly concerned, was to acquaint the public with the specific objectives and nature of the projects and programs being considered; to point out the responsibility and support necessary by Federal, State, and local governments as well as private interests in implementing the projects and programs to be recommended; and to solicit views and opinions from interested parties.

The record shows that 1,197 persons signed registration cards. It is estimated that an additional 120 persons attended but did not register. Total attendance, therefore, was approximately 1,320, an average per meeting of 88 persons. Fifty-two percent of those attending represented chambers of commerce, power companies, development associations, and boating clubs, or signed as individuals (bankers, farmers, and others). Forty-eight percent represented Federal, State, and local governments. Of this latter group, three-fourths were non-Federal.

At each of the public presentations, the Governors of the States directly concerned either attended the meeting or were represented.

Also, the Chairman, Commissioners, and staff personnel made numerous public appearances throughout the basins and in surrounding areas discussing the work of the Commission.

Liaison with the President was maintained in the early phases through President Eisenhower's Special Assistant for Public Works, Major General John S. Bragdon, and Mr. Floyd D. Peterson of General Bragdon's staff. Mr. Peterson addressed the Commission at its initial meeting and expressed views of the Administration. Later, Mr. Peterson succeeded General Bragdon as Special Assistant for Public Works, after which liaison was maintained with him in that capacity. Liaison was also maintained through the Bureau of the Budget. After the change of Administration in 1961, White House contact was made through the Director of the Bureau of the Budget. Chairman Woodruff and Executive Director Tomlinson made the presentations at all hearings before the Bureau of the Budget and Appropriation Committees. The Chairman and Executive Director discussed with the Bureau of the Budget and the executive branch emerging issues coming from discussions at Commission meetings. The Commission, through the Chairman, submitted to the President a Quarterly Status Report beginning in June 1959 and every 3 months following.

Liaison was maintained with all Congressmen and Senators from the study area through personal meetings, letters, activity reports, basin informational pamphlets, and news releases. Senator Richard B. Russell, the author of Public Law 85-850, has maintained close contact with the work of the Commission.

Four of the Commissioners represent the States as nominees of the respective Governors and appointees of the President. As State Commissioners, they are charged by the authorizing legislation with the responsibility of keeping their respective Governors and State agencies informed. In practice, most of the State Commissioners have represented their State during three successive State administrations.

SECTION III – ADVISORY GROUPS

Objectives and Area of Responsibility

The functional and basic committees acted as advisors to the staff specialists. They assisted in

developing work agreements involving needs, opportunities, inventory of existing facilities, schedules, standards, and criteria for the vari-

ous functional and basic studies being contracted.

The Land, Water, and Economics Steering Groups had a broader State and agency representation and had as their principal objective the review of planning objectives, criteria, work plan outlines, basic assumptions, projections, work agreements, study results, and basin plans.

Meetings and Conduct of Business

The functional and basic committees met at the call of the staff member chairman. Meetings were held in offices and in the field as occasion required. These committees also used correspondence as a means of transacting business.

The Land, Water, and Economics Steering Groups met on a more formal basis. At first, each group scheduled its own meetings. As the work progressed and drafts of reports became available, a regular schedule of a 1-day joint meeting per month was adopted. Generally, this meeting occurred 1 week before the monthly Commission meeting.

Data, copies of reports, and other material were sent to steering group members prior to each meeting. Members were encouraged to discuss or comment on basin plans and other topics, not only at the meetings when the item was initially on the agenda, but also at subse-

quent meetings, and directly with the staff between meetings. All meetings were tape recorded, thus preserving a complete record of the discussion. Abbreviated written minutes also were prepared. Between meetings, staff and committee members maintained liaison as needed.

As a general procedure, staff members prepared the agenda, made the formal presentation, and then led the discussion. Maps, charts, graphs, slides, and written documents were used as presentation aids.

Membership

The following list indicates the membership of the steering groups and functional and basic committees. Membership from the States was designated by the respective Governors, while Federal members were selectd by Commissioners from the respective Federal Departments following consultation with various department staff members. In each case, the Chairman was a Commission staff member. There were numerous substitutes and alternates who served either with or in the absence of appointed members, but the names of these individuals have not been listed except where they were actually designated in writing to replace a previously named member.

ECONOMICS GROUP NED L. WILLIAMS, *Chairman*

Member	State or Department and Agency Represented
Ben T. Lanham, Jr.	Alabama (Auburn University)
T. A. Pasto	Florida (Florida Development Commission)
James H. Sayes	Florida (Florida Development Commission)
J. W. Fanning	Georgia (University of Georgia)
G. H. Aull	South Carolina (Clemson College)
C. V. Lyle	U. S. Department of Agriculture (Economic Research Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
Victor Roterus	U. S. Department of Commerce (Area Redevelopment Administration)
Roger A. Prior	U. S. Department of Commerce (Area Redevelopment Administration)
Richard H. Kraft	U. S. Department of Commerce (Area Redevelopment Administration)
C. L. Fishburne, Jr.	Federal Power Commission
John R. Thoman	U. S. Department of Health, Education, and Welfare (Public Health Service)
W. G. Eichberger	U. S. Department of Health, Education, and Welfare (Public Health Service)
W. L. Towns	U. S. Department of the Interior (Fish and Wildlife Service)

Member	State or Department and Agency Represented
LAND GROUP	
<i>J. F. ANDERSON, Chairman</i>	
John O. Boynton	Florida (Florida Development Commission)
James H. Sayes	Florida (Florida Development Commission)
Garland Peyton	Georgia (Georgia Department of Mines, Mining, and Geology)
Frank E. Harrison	South Carolina
J. A. Johnson	U. S. Department of Agriculture (Soil Conservation Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
J. W. Wyckoff	Federal Power Commission
John R. Thoman	U. S. Department of Health, Education, and Welfare (Public Health Service)
Herbert H. Rogers	U. S. Department of Health, Education, and Welfare (Public Health Service)
W. L. Towns	U. S. Department of the Interior (Fish and Wildlife Service)

WATER GROUP

W. T. WILSON, *Chairman* (prior to February 1960)

C. M. CONWAY, *Chairman* (February 1960 and after)

Arthur N. Beck	Alabama (Alabama Department of Health)
John W. Wakefield	Florida (Florida Board of Conservation)
Roy J. Boston	Georgia (Georgia Department of Public Health)
H. J. Webb	South Carolina (Clemson College)
T. B. Chambers	U. S. Department of Agriculture (Soil Conservation Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
William E. Fox	U. S. Department of Commerce (Weather Bureau)
E. R. Griffith	Federal Power Commission
John R. Thoman	U. S. Department of Health, Education, and Welfare (Public Health Service)
W. L. Towns	U. S. Department of the Interior (Fish and Wildlife Service)

INDUSTRIAL ECONOMICS COMMITTEE

HARRY C. WOLFE, *Chairman* (prior to October 1960)

NED L. WILLIAMS, *Chairman* (October 1960 and after)

Porter Howell	Alabama (Alabama Planning and Industrial Development Board)
T. A. Pasto	Florida (Florida Development Commission)
Kenneth Wagner	Georgia (Georgia Institute of Technology)
J. Wesley Davis	South Carolina
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
Roger A. Prior	U. S. Department of Commerce (Area Redevelopment Administration)
W. G. Eichberger	U. S. Department of Health, Education, and Welfare (Public Health Service)
Harry F. Wright	U. S. Department of the Interior (Southeastern Power Administration)

Member	State or Department and Agency Represented
AGRICULTURAL ECONOMICS COMMITTEE	
C. C. TAYLOR, <i>Chairman</i>	

Ben T. Lanham, Jr.	Alabama (Auburn University)
H. G. Hamilton	Florida (University of Florida)
J. W. Fanning	Georgia (University of Georgia)
G. H. Aull	South Carolina (Clemson College)
C. V. Lyle	U. S. Department of Agriculture (Economic Research Service)
Rolland B. Handley	U. S. Department of the Interior (Fish and Wildlife Service)

AGRICULTURAL COMMITTEE	
HORACE P. MORGAN, <i>Chairman</i>	

Hugh Brown	U. S. Department of Agriculture (Soil Conservation Service—Georgia)
H. B. Helms	U. S. Department of Agriculture (Soil Conservation Service—Florida)
R. N. Hoit	U. S. Department of Agriculture (Soil Conservation Service—Alabama)
J. A. Jordan	U. S. Department of Agriculture (Soil Conservation Service—South Carolina)
J. A. Johnson	U. S. Department of Agriculture (Soil Conservation Service)
C. V. Lyle	U. S. Department of Agriculture (Economic Research Service)
C. E. Newnam	U. S. Department of Agriculture (Soil Conservation Service—Alabama)
George M. Renfro, Jr.	U. S. Department of Agriculture (Soil Conservation Service)
John Roehl	U. S. Department of Agriculture (Soil Conservation Service)
William A. Schlaudt	U. S. Department of Agriculture (Soil Conservation Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
Albert N. Cameron	U. S. Department of the Interior (Geological Survey)
J. W. Geurin	U. S. Department of the Interior (Geological Survey)
M. T. Thomson	U. S. Department of the Interior (Geological Survey)

FLOOD CONTROL COMMITTEE	
DONALD E. WHELAN, <i>Chairman</i>	

Eugene C. Buie	U. S. Department of Agriculture (Soil Conservation Service)
C. V. Lyle	U. S. Department of Agriculture (Economic Research Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
William E. Fox	U. S. Department of Commerce (Weather Bureau)

HYDROLOGY COMMITTEE	
W. T. WILSON, <i>Chairman</i>	

Norman Leach	U. S. Department of Agriculture (Soil Conservation Service)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
William E. Fox	U. S. Department of Commerce (Weather Bureau)
J. T. Callahan	U. S. Department of the Interior (Geological Survey)
Albert N. Cameron	U. S. Department of the Interior (Geological Survey)
M. T. Thomson	U. S. Department of the Interior (Geological Survey)

Member	State or Department and Agency Represented
FISH AND WILDLIFE COMMITTEE	
<i>ROY Wood, Chairman</i>	
Walter Beshears	Alabama (Alabama Department of Conservation)
I. B. Byrd	Alabama (Alabama Department of Conservation)
W. L. Holland	Alabama (Alabama Department of Conservation)
Richard Eickhorn	Florida (Florida Game and Fresh Water Fish Commission)
E. T. Heinen	Florida (Florida Game and Fresh Water Fish Commission)
Donald Strode	Florida (Florida Game and Fresh Water Fish Commission)
William Wood	Florida (Florida Game and Fresh Water Fish Commission)
George Moore	Georgia (Georgia State Game and Fish Commission)
Howard Zellar	Georgia (Georgia State Game and Fish Commission)
Jefferson C. Fuller	South Carolina (South Carolina Wildlife Resources Department)
Frank P. Nelson	South Carolina (South Carolina Wildlife Resources Department)
Howard A. Miller	U. S. Department of Agriculture (Forest Service)
E. Arnold	U. S. Department of the Interior (Fish and Wildlife Service)
Spencer H. Smith	U. S. Department of the Interior (Fish and Wildlife Service)

FORESTRY COMMITTEE

ALBERT H. SPECTOR, Chairman

John M. McCullough	Alabama (Alabama Department of Conservation)
John A. Butz	Florida (Florida Forest Service)
William H. McComb	Georgia (Georgia Forestry Commission)
E. L. Middleswart	South Carolina (South Carolina State Commission of Forestry)
Cecil Clapp	U. S. Department of Agriculture (Forest Service)

RECREATION COMMITTEE

WILLIAM H. APPEL, Chairman

Orrie W. Hanson	U. S. Department of Agriculture (Forest Service)
F. J. Guscio	U. S. Department of the Army (Corps of Engineers)
C. E. Richey	U. S. Department of Health, Education, and Welfare (Public Health Service)
Rolland B. Handley	U. S. Department of the Interior (Fish and Wildlife Service)
Robert Squier	U. S. Department of the Interior (National Park Service)

HYDROELECTRIC POWER COMMITTEE

BURLE C. LATON, Chairman

Leslie F. Johnson	U. S. Department of the Army (Corps of Engineers)
E. R. Griffith	Federal Power Commission
Thomas H. Wigglesworth	U. S. Department of the Interior (Southeastern Power Administration)

Member	State or Department and Agency Represented
WATER USE AND PUBLIC HEALTH COMMITTEE	
RICHARD F. POSTON, <i>Chairman</i> (prior to August 1961)	
LEWIS A. YOUNG, <i>Chairman</i> (August 1961 and after)	
Arthur N. Beck	Alabama (Alabama Department of Health)
David B. Lee	Florida (Florida State Board of Health)
Roy J. Boston	Georgia (Georgia Department of Public Health)
William T. Linton	South Carolina (South Carolina State Board of Health)
Laurence G. Leach	U. S. Department of the Army (Corps of Engineers)
John R. Thoman	U. S. Department of Health, Education, and Welfare (Public Health Service)
J. W. Geurin	U. S. Department of the Interior (Geological Survey)

NAVIGATION COMMITTEE
L. W. ANGELL, *Chairman*

Leslie F. Johnson	U. S. Department of the Army (Corps of Engineers)
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SECTION IV – COOPERATORS AND CONTRACTORS

In the spring of 1959, the Commission decided that the staff would be relatively small and used for the purposes of initiating and guiding technical work to be performed by contractors and cooperators, reviewing the reports, augmenting them as necessary, and then adapting them to Commission objectives.

Under the Act, Public Law 85-850, the responsibility for (1) the appointment and supervision of personnel employed by the Commission, (2) the distribution of business among such personnel, and (3) the use and expenditure of funds is vested in the Chairman and not in the Commission, all in accord with the general policies of the Commission.

Under this responsibility, documents for proposed contracts with cooperators were prepared by the staff, submitted to the Chairman for approval and signature, and then implemented by the staff in accordance with the contract and the working agreements subsequently developed. Lists of pending contracts and agreements also were furnished the Commissioners and discussed at the Commission meetings. Contracts and supervised studies numbered about 250.

In many cases, cooperators furnished data free of charge. In the case of cost-reimbursable contracts with State agencies and institutions, their records of costs were reviewed and audited by the Commission prior to final payments.

Studies were classified as:

1. Basic (pertaining to economics, hydrology, engineering, and geology).
2. Functional (pertaining to single-purpose functions listed in Public Law 85-850).
3. Terminal (pertaining to multiple-purpose projects and programs, clarification of problems and augmenting data).

Cooperators.

The following cooperators provided the major agency assistance to the Commission:

State
<i>Alabama</i>
Department of Agriculture
Auburn University
Department of Conservation
State Docks Department
Extension Service
Division of Forestry
Geological Survey
Department of Public Health
Highway Department
State Planning and Industrial Development Board
Department of Labor
Pilotage Commission
Public Service Commission
River Development Board
Soil Conservation Committee
Soil Conservation Districts
Water Improvement Commission

Florida

Department of Agriculture
Board of Conservation
Development Commission
Extension Service
Florida State University
University of Florida
Forest Service
Game and Fresh Water Fish Commission
State Board of Health
Industrial Commission
Inland Navigation District
Board of State Parks and Historical Monuments
Railroad and Public Utilities Commission
Road Department
Soil Conservation Board
Soil Conservation Districts
Suwannee River and Water Conservation Authority

Georgia

Department of Agriculture
Bainbridge Port Authority
Brunswick Port Authority
Extension Service
Forestry Commission
Game and Fish Commission
University of Georgia
Georgia Institute of Technology
Georgia State College
Georgia Southern College
Department of Public Health
Department of Industry and Trade
Jekyll Island State Park Authority
Highway Department
Department of Labor
Department of Mines, Mining, and Geology
Department of State Parks
Georgia Ports Authority
Public Service Commission
Savannah District Authority
Soil and Water Conservation Committee
Soil and Water Conservation Districts
Tidewater Commission
Water Quality Council
Water Resources Commission
Waterways Commission

North Carolina

State Board of Conservation and Development
Extension Service
Highway Department
North Carolina State College

Western North Carolina Regional Planning

Commission
Soil Conservation Committee
Soil Conservation Districts
Department of Water Resources
Wildlife Resources Commission

South Carolina

Department of Agriculture
Clemson College
Development Board
Extension Service
Forestry Commission
State Board of Health
Department of Labor
Congaree Navigational Study Committee
Parks Commission
Ports Authority
Public Service Authority
Public Service Commission
Soil Conservation Committee
Soil Conservation Districts
Committee for Water Development
Water Pollution Control Authority
Wildlife Resources Department

General

Altamaha Development Association
Middle Chattahoochee Development Association
Upper Chattahoochee Development Association
Choctawhatchee-Pea Development Association
Council of State Governments
Southern Regional Education Board
Southeastern Power Committee of Electric Membership Cooperatives of Nine Southeastern States
Three Rivers Development Association

Federal

U. S. Department of Agriculture
Agricultural Marketing Service
Agricultural Research Service
Agricultural Stabilization and Conservation Service
Economic Research Service
Farmers Home Administration
Forest Service
Soil Conservation Service

U. S. Department of the Army
Beach Erosion Board
Board of Engineers for Rivers and Harbors
Corps of Engineers
Military Posts

Atomic Energy Commission
Atlanta Federal Reserve Bank
U. S. Civil Service Commission
U. S. Department of Commerce
 Area Redevelopment Administration
 Business and Defense Services Administration
 Bureau of the Census
 Office of Business Economics
 Bureau of Public Roads
 Small Business Administration
 Weather Bureau
Federal Power Commission
General Services Administration
U. S. Department of Health, Education, and Welfare
 Public Health Service
Housing and Home Finance Agency
U. S. Department of the Interior
 Bureau of Commercial Fisheries
 Geological Survey
 Bureau of Mines
 National Park Service
 Bureau of Reclamation
 Bureau of Outdoor Recreation
 Southeastern Power Administration
 Bureau of Sports Fisheries and Wildlife
U. S. Department of Labor
 Bureau of Labor Statistics
U. S. Department of the Navy
 Sixth Marine Corps Reserve and Recruitment District
Executive Office of the President
 Bureau of the Budget
 Public Works Planning
Outdoor Recreation Resources Review Commission
Advisory Commission on Intergovernmental Relations
Select Committee on National Water Resources, U. S. Senate, 86th Congress
Smithsonian Institution
U. S. Study Commission – Texas
Tennessee Valley Authority
 In addition, the Commission gratefully acknowledges assistance received from numerous county and municipal governments, planning commissions, development commissions, chambers of commerce, corporations, trade associations, interested individuals, the press, radio, and television, and professional societies.

Contractors

The following is a list of Federal and State departments, agencies, and institutions with whom contracts and agreements were made for technical services in addition to arrangements made with individuals enumerated in Part Two.

Federal

U. S. Department of Agriculture
 Economic Research Service
 Forest Service
 Soil Conservation Service
U. S. Department of the Army
 Corps of Engineers
Department of Commerce
 Business & Defence Services Administration
 Census Bureau
 Weather Bureau
Federal Power Commission
Department of Health, Education, and Welfare
 Public Health Service
Department of the Interior
 Bureau of Commercial Fisheries
 Geological Survey
 National Park Service
 Bureau of Sport Fisheries and Wildlife
Department of Labor
 Bureau of Labor Statistics

State

Alabama
 Auburn University
 Alabama Department of Conservation
 Water Improvement Commission of Alabama
Florida
 University of Florida
 Florida Forest Service
 Florida Game and Fresh Water Fish Commission
 Florida State Board of Health
 Florida Industrial Development Commission
Georgia
 University of Georgia
 Georgia Institute of Technology
 Georgia State College of Business Administration
 Georgia Forestry Commission
 Georgia Game and Fish Commission

<i>South Carolina</i>	
Clemson College	Eagle Empire Printing Company
South Carolina Game and Fish Commission	Foote & Davies
South Carolina State Commission of Forestry	Foto-Plates, Inc.
<i>North Carolina</i>	Fulton Letter Service, Inc.
North Carolina State College	Howard Printing Company
Corporation, Company, or Individual	McDonald Printing Company
George Aase & Associates	Modern Talking Picture Service, Inc.
Ad-Stat Art and Photocopy Service	Charles A. Rawson and Associates
Martha S. Albertson Mapping Service	Sign-Craft Company
Columbus Office Supply Co.	Ben C. Smith Signs
Crossley S-D Surveys	The Stein Printing Company
	Marvin Zukerman

SECTION V - REVIEW PROCEDURES

The review procedure is outlined in Public Law 85-850 and the Flood Control Act of 1944, as set forth in Part One of this Appendix. The proposed Report of the Commission and supporting appendixes were sent to the Federal Departments and Governors for review and comment during the week of February 18 to 22, 1963. Comments were received from the States and Federal Departments on the following dates.

Alabama	May 22, 1963
Florida	May 15, 1963
Georgia	May 16, 1963
North Carolina	June 17, 1963
South Carolina	None received (as of August 15, 1963)

U. S. Department of Agriculture	June 3, 1963
U. S. Department of the Army	June 24, 1963
U. S. Department of Commerce	June 17, 1963
Federal Power Commission	May 15, 1963
U. S. Department of Health, Education, and Welfare	June 10, 1963
U. S. Department of the Interior	June 20, 1963

The official review comments received are included in the volume containing the Report of the Commission.